

Landfills and Other Waste Sites in Virginia – Threats to Health and the Environment

A Sierra Club – Virginia Chapter report



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Executive Summary

This report examines the problem of leaking landfills and other waste disposal sites in Virginia, based on data from Department of Environmental Quality (DEQ) files, a report ordered by DEQ for the General Assembly, the report House Document 85, and the open literature. A report by Ogden Environmental Services (Ogden, 1996) prepared for the General Assembly lists 2015 abandoned waste sites, at least half of which could be landfills. Due to funding constraints, a sample (250) of the 2015 sites were studied more closely, which produced a percentage that was not abandoned. Projecting the sample study results upon the total number of sites, the report concluded that a total of 371 to 461 of abandoned sites may pose a risk to human health and the environment. DEQ also lists 990 permitted waste sites, of which 265 are landfills, over half of which may currently be contaminating groundwater.

Estimated cleanup costs for 371 to 461 abandoned waste sites range from \$277 to \$670 million, for sites that present a risk sufficient to require cleanup. This estimate is based on the Ogden report. These estimates have not been updated or adjusted for inflation or changes in site status. The specific sites requiring clean up can only be identified by a file search and assessment, site visits and testing of each site, costing at least \$875,000 including the costs of site testing.

DEQ data indicate that groundwater monitoring wells at 164 of the 265 permitted landfills show contamination. DEQ has determined that 48 of these landfills are the source of the groundwater contamination and corrective action measures are being developed. Permitted landfills are the financial responsibility of the permit holder who must monitor and conduct any necessary corrective action measures to protect the ground water. There is no estimate of costs to the state to evaluate and cleanup the 265 (as of 12/2001) permitted landfills although DEQ regulations require one million dollars of financial assurances for corrective action until a specific remedy is selected. In addition to any remedial costs, the state must pay the administrative costs for oversight of these permitted landfills, including administration, evaluation and inspection. There is no requirement or plan to close these landfills once there are groundwater impacts.

Recommendations

1. Conduct a file investigation and assessment to determine the number of abandoned and permitted waste facilities that are contaminated, and those that require additional soil and water sampling;
2. Conduct field investigations to confirm the results of the file investigation and to obtain samples for assessing contamination of sites that presently have no data;
3. Obtain cost estimates for clean up, closure, remediation of the contaminated waste sites identified above;
4. Appropriate, allocate, raise funds necessary to close, clean up, and remediate the contaminated waste sites in the state.
5. Publish and make available on-line monitoring data and reports.
6. Publish and make available on-line, a list of locations of the contaminated waste sites in the state, with the risk ranking. In cases where the ranking is uncertain, the state needs to err on the side of public health protection and classify unknown sites as high risk.

Introduction

The Commonwealth of Virginia again awoke to the solid waste disposal problem in 1998 with the public disclosure and realization of the vast amount of solid waste imported from other states for disposal in Virginia. This issue was not new to either the state agencies or the General Assembly. In 1993, due in large part to the disaster and abandonment of the Kim-Stan landfill in Alleghany County by its owners (see Appendix A), the General Assembly commissioned an assessment of abandoned waste sites (Item 399.2 C of the 1993 Appropriation Act). The General Assembly was interested in knowing the danger to public health and the environment and the cost of cleaning up the contamination. DEQ subsequently contracted Ogden Environmental Services to conduct the risk assessment (Ogden, 1996). The present report deals with the nature of the risks from abandoned and permitted waste sites, particularly landfills, and summarizes information on costs of closure, monitoring, maintenance, and cleanup.

The Ogden report (using DEQ data) served as a starting point from which to examine the extent to which solid waste disposal in the Commonwealth poses a threat to public health and the environment. Other information on solid waste disposal is maintained by the DEQ in the form of files on permitted waste disposal facilities, both open and closed. Together, these two sets of data on abandoned and permitted solid waste facilities should comprise basic information held by The Commonwealth on waste disposal sites.

Background

Landfills are the modern version of the old open “dump” where everyone simply threw their trash and the town covered it up every so often. Various state and federal initiatives led to laws prohibiting open dumps, and requiring disposal of waste in properly designed and operated disposal facilities. By law, disposal facilities must be permitted and comply with regulations for design, operation, groundwater monitoring, closure and post-closure care, corrective action and financial assurance. The intent of the program is to protect the environment and public health from threats posed by the waste and the breakdown of that waste over time. In the late 1980's, federal (Subtitle D of the Resource Conservation and Reclamation Act, RCRA) and state laws changed solid waste disposal and management practices in the US. Landfill design and operation now had to meet new and stricter standards in order to protect surface and groundwater resources and to keep waste away from the public. One of the determining events was discovery of medical waste on the beach and where children could play with it.

Solid waste poses a threat to public health and the environment because of certain toxic constituents in the waste, and because the waste can generate or produce other dangerous or toxic materials. Some of the waste itself may pose an immediate threat: sharp objects in medical waste, broken glass, and metal edges are examples of such waste. The materials produced from waste include toxic chemicals and diseases that can be present in the waste, in emissions from the waste, or in water that has run through the waste. Solid waste landfills are sources of toxic chemicals and microbes (bacteria, viruses, fungi, etc.) that can be released from the landfill into the air, water or soil near the landfill.

Landfills are basically shallow depressions in the ground that are lined with compacted clay and heavy plastic sheets; newer landfills also have pipes in the bottom of the landfill to collect any liquid that is produced (leachate). Modern landfills are carefully designed and engineered, tested during construction and inspected. Nonetheless, such modern facilities have only been in use for a decade or so, and they need to remain operating and safe for much longer - more than 30 years and the long term performance of these has not been tested or evaluated. The waste will remain for even longer periods, perhaps forever.

Landfills, especially closed ones and those operating exactly as designed, produce two types of releases, gas and liquid. Gases are produced by the chemical and bacterial decomposition of the organic material in the waste. Food scraps, yard waste, paper, and sludge from sewage treatment plants are the types of organic materials in most landfills. The bacteria often produce methane, carbon dioxide, some hydrogen sulfide, alcohols, and other organic gases. The heat generated by decomposition can also cause chemicals to volatilize and go from the liquid to gas form. These compounds are known as volatile organic compounds and include

solvents, gasoline, alcohols, cleaning agents, etc. Normally, the gases are vented through pipes installed on the top of a closed landfill and the gas simply passes up into the atmosphere from ground level. If methane is the primary gas, and produced in large enough quantities, it may be collected, cleaned and used for heat. Thus, gaseous emissions from a landfill are normal and inevitable, and include a range of compounds found in or produced by the waste as it decomposes.

Liquids, called leachate, are produced by solid waste in a landfill either as it is squeezed out of wet garbage, liquid waste, etc., or as rainwater seeps into the landfill. Water may seep in to landfills from the bottom of those that are not functioning properly or in older, unlined landfills. A small amount of water is actually produced by the action of decomposition. Liquid wastes from a landfill are supposed to flow into the bottom of the landfill and then into the leachate collection system. Normal operating procedures then call for treatment of this liquid waste in a waste treatment facility, often the local sewage treatment plant. Rainwater that flows off the surface (and does not seep in) is supposed to be diverted from the active landfill area and collected as other storm water would be from a parking lot, and then treated accordingly. Unfortunately, not all landfills are designed or operated perfectly to keep liquid waste from escaping; older landfills have little or no features to prevent seeping. As a result, many landfills leak leachate into the ground and groundwater beneath and around the facility, and/or into the surface water (streams, lakes, rivers, etc.).

Virginia DEQ keeps track of both permitted and unpermitted waste facilities, some of which are landfills; the remainder are waste handling locations such as transfer stations or material recovery facilities. In addition, DEQ keeps track of pollution incidents and contaminated property where cleanup is required because of a spill or other mismanagement of waste. Permitted facilities are listed on DEQ websites in two different databases, and further details are provided on those sites. To summarize the information on these waste sites:

Abandoned (estimated) waste sites in 1995 (Ogden) 2015

Permitted waste facilities in 2002 990

Landfills 265

Leaking landfills 164

Landfills requiring Groundwater Protection Systems 48

<http://www.deq.state.va.us/waste/s-waste.html>

Permitted Facilities

The DEQ databases list two different types of solid waste facilities, permitted ones that are either in operation or closed, and those that are abandoned. The facilities include landfills, transfer stations, storage facilities, other processing plants, lagoons, and other waste facilities. The file on permitted waste processing or handling facilities contains entries for 990 facilities in the state, listed by DEQ Region. The permitted landfills are classified according to the type(s) of waste disposed at the facility. Of the nearly 1000 listings, 265 are actually permitted landfills (see Table 1 for Dec 2001 data). The remaining are other sorts of waste handling or storage facilities.

According to state laws and regulations, landfills must install wells that allow monitoring the groundwater beneath and in the vicinity of the landfill. These groundwater monitoring wells are sampled regularly to provide evidence regarding the integrity of the landfill liner and the groundwater. If groundwater monitoring reveals evidence that the landfill is leaking, then the landfill owner must implement corrective action measures to protect the ground water. State law also requires that owners or operators of landfills provide assurance that they have the financial capability to maintain the landfill, close it when the time comes, monitor during the post-closure period, and take care of any clean up.

The permitted waste facilities in Virginia (landfills, transfer stations, storage facilities, etc.) are distributed in every county and city (Figure 1). The Ogden report only deals with abandoned sites, not these permitted facilities. The nearly 1000 permitted solid waste facilities, including landfills, are listed in the DEQ database that can be reached at <http://deq.va.us/waste/s-waste.html>. The landfills, 265 of the total, are required to submit annual reports to DEQ on the status of groundwater and air emissions (methane and combustibility). DEQ keeps records on these landfills, including the permit, monitoring reports and other information. If any landfill monitoring report indicates a problem with groundwater contamination, the landfill owner is required to take specific steps, including modifying the permit, enhancing the monitoring frequency and implement corrective action measures such as pumping and treating the groundwater. Virginia regulations require that DEQ hold public hearings when the permit is significantly modified and the state maintains records of these public hearings. The permit holder must notify residents if a contaminated plume leaves the property boundary. Notification occurs via letter from the permit holder to the neighboring landowners.

Information was not available online at the DEQ web site regarding monitoring report results in summary form. Examination of the individual facility files would be needed to extract that information for each facility, as Ogden did for the

abandoned sites. Annual reports and other technical analyses in the facility files indicate the results of chemical analyses of groundwater monitoring wells.

Information from DEQ provided in Table 1 indicates that 62% of these permitted landfills (164 of 265) show contamination in a groundwater monitoring well with the designation of either Phase II or Assessment status. If a facility is in Phase II or Assessment, there is an indication or actual release of pollutants to the groundwater. The terms Detection and Assessment are used for sanitary landfills and Phase I and Phase II are used for construction, demolition, and debris (CDD) landfills. If a facility is in Phase I or Detection, then there is no indication of a release to groundwater. After a Statistically Significant Increase (SSI) in chemicals in groundwater at a sanitary landfill, the facility goes to assessment and remains in that program unless it can be demonstrated that the SSI is caused by something other than the facility or a corrective action remedy is selected. It is the same for Phase I and II except that the first part of Phase II must make a demonstration whether there is an actual release to groundwater before the facility remains in Phase II.

The groundwater monitoring frequency is semiannual in all programs except for active sanitary landfills “connected” to nearby wetlands, which are then quarterly. If a Groundwater Protection Standards (GPS) has been established, and has been exceeded, the facility must install additional wells to determine the extent of the contamination and notify all persons living adjacent to the plume. The GPS information is incorporated into the permit and is not available on-line or anywhere else.

DEQ stresses that this indication does not mean that the landfill is leaking, but only that something is contaminating the groundwater. If DEQ takes action to determine the source of contamination, permittees are given an opportunity to demonstrate that the contamination is coming from somewhere other than the landfill. If DEQ does determine that the permittee is the source of contamination, permittees are required to develop and implement corrective action measures.

DEQ keeps track of ground water monitoring results and compliance with the required response measure, but is not authorized to prepare a consolidated report. Some of the landfills that have reported chemicals in the groundwater monitoring wells; some have found chemicals in the plumes outside the boundaries of the property. A total of 48 facilities have exceeded or established a GPS; most are county/city facilities or industrial landfills (Table 2). Although the number of landfills with GPS's is not large, it represents about 18% of the total number of permitted landfills that have some problem with groundwater contamination. According to Table 1, 141 of the 265 permitted landfills are required to establish a GPS. Of those 141, only 48 (Table 2) have established a GPS, and of those, 29 have exceeded the GPS.

A local example in Richmond city of a closed, permitted landfill having problems, located near a residential area and in likely need of cleanup or remediation, is the East Richmond Landfill. Monitoring in the early 1990's revealed unacceptable levels of gas emissions, such as methane, and there were also indications of groundwater contamination. (See East Richmond Landfill Report, Appendix C)

Abandoned Sites

1993 DEQ Survey of Abandoned Waste Sites

The closing and abandonment of the Kim-Stan landfill in Alleghany County by its owners in 1990, although receiving the greatest amount of publicity at that time, is not the only site in Virginia where waste has been improperly disposed of and where a person/s financially responsible, able, and willing cannot be identified or held accountable. The General Assembly's 1993 Appropriation Act directed DEQ (then the Department of Waste Management) to determine how many abandoned waste sites in the state that require significant corrective action. As part of that task, DEQ was to provide

1. a survey of abandoned solid and hazardous waste sites,
2. a cost estimate of remediating those sites posing the highest degree of threat to health and the environment, and
3. a summary of the mechanisms used in other states for funding remediation of such sites.

In November 1993, DEQ submitted its findings to the Governor and the chairmen of the Senate Finance and House Appropriations Committees. It listed over 2,000 abandoned waste sites, including sites where disposal or improper management of wastes were known or highly suspected to have occurred and were not undergoing remediation.

DEQ disclosed that it did not have adequate information to determine whether the sites on the list were actually "abandoned" by their owner, and that it also did not know the risks from the sites' contamination, again because of inadequate information. Thus DEQ could not prioritize the sites' risks nor calculate remediation costs. DEQ estimated a minimum of 10 percent, or 200 to 250, of the sites posed significant problems that should be cleaned up or could require action. DEQ also recommended that \$300,000 be provided to fund a study to examine each site in greater detail in order to fully carry out the 1993 General Assembly's instructions. DEQ also proposed providing strategies to remediate sites for each risk category and that the General Assembly review funding mechanisms of other states to determine a suitable funding mechanism for Virginia.

In February 1994, DEQ released a list of over 2,168 abandoned waste sites. The list included reported incidents, such as spills and intentional dumpings which may not represent actual contamination or illegal activity. Of the original entries, 153 were removed due to duplications, informational errors, the inclusion of sites on the Superfund National Priority List, and sites later determined not to be "abandoned."

The Ogden Risk Assessment Report

The 1994 Session of the General Assembly authorized funding (\$125,000) for a risk assessment of abandoned solid and hazardous waste sites and to estimate the costs to remediate identified risks, and to prioritize remedial actions according to the threat to public health or safety. In October 1994, DEQ awarded a contract for the assessment to Ogden Environmental and Energy Services Company, Inc.

The Ogden report (Ogden 1996) reviewed the DEQ databases for abandoned waste sites to assess the risks and the costs of clean up. From the database of 2015 total sites, Ogden selected a subset of 250 sites to review (see Appendix E, Ogden Risk Assessment Results) and then extrapolate to the larger set of sites. The review yielded data on contaminants at each site, as well as the status, location, owner, age, permit date and other relevant file information. The contaminant information was used with the known data on contaminant toxicity to estimate health risks. Ogden then used the information of the subset of sites to estimate the total number of sites with high risks in the entire state. The result is an estimate of the number of sites that need clean up around the state and an approximation of cleanup costs, but not an accounting of specific sites, contaminants and associated risks. The Ogden report cannot provide a list of all the sites in Virginia that need clean up; only a review of the files or other databases in DEQ can yield that information.

The current DEQ database lists 2015 abandoned waste sites in the entire state, distributed among every county and city (Figure 2) listed on the DEQ web site: <http://www.deq.state.va.us/waste/s-waste.html>. These sites include landfills, transfer stations, places where one old container spilled and other assorted and undescribed dumps. Some are truly waste sites; others are not. The Ogden report found that 117 of the 250 sites studied in detail in 1994-5 were not abandoned.

The present report can estimate the types of risks of the approximate percentage of abandoned sites reported in the Ogden report. Ogden estimated that between 371 (18.4%) and 467 (23.2%) of the 2015 listed abandoned sites present a risk sufficient to require clean up. The reason the range is so wide is that there are 56 sites with little or no data and no one can estimate the risks from these sites. Secondly, Ogden applied two different sets of clean-up standards, one presuming industrial use (lower cost), the other presuming residential use (higher cost). The more stringent standard would result in 411 high-risk sites, the less stringent standard would require clean up at 371 sites. If none of the unknown sites need clean up and the less stringent standard is used (the minimum number), then 371 sites need clean up. If all the unknowns need clean up and the more stringent standard is used (maximum number), then 467 sites need clean up. There is no way of knowing the exact location of the high-risk sites, or even the exact number until the files are

examined individually. If these same percentages from the Ogden (1996) report apply to the present waste sites, then 400-503 sites may require clean up.

1997 Joint Subcommittee Report: House Document 85

In 1994, the General Assembly also formed a joint subcommittee to examine the financial role and responsibility of the state to help localities in remediating abandoned solid or hazardous waste sites. The 1995 General Assembly further directed the subcommittee to examine ownership, access, and residual value issues regarding abandoned waste sites and the establishment of financial responsibility for their cleanup. It also directed the subcommittee to recommend funding mechanisms and a timetable for the cleanup of those sites considered to pose the most immediate threat to public health and safety. The Office of the Attorney General was also to help support the study.

The 1996 General Assembly House Joint Resolution No.193 authorized the continuance of the joint subcommittee for a third year and directed the subcommittee to submit its findings and recommendations to the next General Assembly. They were submitted in House Document 85, The Appropriate Financial Role and Responsibility of the Commonwealth, If Any, To Assist Localities in Remediating Abandoned Solid or Hazardous Waste Sites. (See Appendix B, House Document 85 Executive Summary)

Health Risks

The Ogden report identified 38 sites of the 250 that were sub-sampled (2015 total) that had sufficiently high contamination to pose high risks to the nearby residents (Figure 3). The highest risk ranking was based on the concentrations of toxic chemicals in soil, sediment, water, and air. These sites are located throughout the state, as far west as Roanoke, to the east in Norfolk, in the city of Richmond, in Loudon County to the north, and other cities and counties (Figure 3). Many of the 38 sites are industrial sites owned and/or operated by private companies and are industrial waste sites. The chemical contaminants are metals, heavy metals, organic compounds, pesticides, solvents, banned chemicals, and petroleum products (Table 3). Many of the sites are contaminated with polynuclear aromatic hydrocarbons (PAH's), the chemicals found in creosote and combustion waste.

The chemicals reported as contaminants at the high-risk waste sites in the Ogden report cover a wide range of industrial, agricultural and retail chemicals. Banned pesticides include DDT (and its breakdown products DDD and DDE) and chlordane. PCB's were reported at several sites, despite the fact that these highly toxic chemicals were banned over 25 years ago in the passage of the federal Superfund law. PAH's were reported at many of the sites, not a surprising finding because these are products of petroleum combustion and of creosote facilities. Every metal and heavy metal is found on the list, many coming from various general industrial metal processing, others, such as lead, from specific activities such as smelting.

Chemicals were most often found in the soil, but surface water, sediment and groundwater were also reportedly contaminated. Chemical levels were generally highest in soils and lowest in groundwater, due to the fact that many of these chemicals are not highly soluble in water and in fact adhere to soils and sediments. The heavy organic chemicals, such as dioxins, PCB's, PAH's, and chlorinated pesticides are such contaminants.

With such a wide range of toxic compounds, it is not surprising that the toxic health effects are equally as varied. Toxicological information from the ATSDR (Agency for Toxic Substances and Disease Registry) of the Centers for Disease Control Toxicological Profiles was used as the source for listing the effects, sources and pathways for chemicals found to be emitted by landfills in a study on California. This particular database was established by act of Congress for Superfund applications and has become a widely used source of toxicological information. The effects range from short term neurological and respiratory problems for anyone breathing fairly high levels, to cancer from long term exposure to low levels of some compounds. There is no way to generalize the effects of such a wider range of compounds that act on literally every system of the body through dozens of mechanisms.

Landfills are known to act as sources of contaminants that threaten human health. Investigations by Brown and Donnelly (1988), Dolk et al. (1998) and those summarized in the IOM (Institute of Medicine, 1999) document the health threats from landfills and the toxic chemicals from landfills. Dolk et al. (1998), in fact, found that the health effects of living near hazardous waste landfills are measurable in a local population. This issue is one that was raised approximately 15 years ago in North Carolina when the United Church of Christ raised the problem of environmental justice/injustice regarding landfills (see IOM, 1999).

There are basically four pathways for exposure to toxic chemicals from landfills: breathing them, absorption through the skin, eating or drinking them, and in utero exposure across the placenta or via breastfeeding. Breathing, or inhalation exposure, is an important exposure pathway for volatile compounds in the air and for dust, including contaminants that are attached to dust. Volatile organic compounds, or VOC's, are regular emissions from landfills and are present at many of the contaminated sites identified by Ogden. One careful study of VOC emissions from landfills was done by the California Air Resources Board (CARB, 1990) to estimate the exposure of nearby people to such gases. CARB (1990) reported that the 10 most commonly occurring VOC's in landfills were in fact found in the emissions from a series of municipal solid waste landfills (Table 3). They also reported these compounds were found in ambient air in off site residential areas.

Absorption through the skin is most effective for VOC's and similar substances that dissolve readily in oils and fats and are small molecules (hence why these also volatilize). The skin actually functions as a barrier to many things, and keeps water in, as well as other chemicals and water on the outside. But contact and dermal absorption is significant for workers and children who may come in direct contact with contaminated material (soil, waste, etc.).

Food and water are one of the most significant exposure pathways for many of the worst environmental pollutants. This pathway includes both drinking water as well as food and accidental or incidental ingestion. Groundwater in the US is assessed by the US Geological Survey (as well as local and state health departments). Recent data indicates a surprisingly high number of groundwater systems that are contaminated with pesticides, fertilizers and industrial compounds (Squillace et al., 2002). Accidental or incidental is significant in children who often do not wash their hands before putting them in their mouths or eating. Contaminated foods can be meats (fish, poultry, beef, pork, etc.) that have been raised in the vicinity of a source of contaminants. Contamination also gets into our foods from other sources that are not related to solid waste facilities (e.g. incinerators, power plants).

The final pathway is fetal exposure to chemicals that come from the mother's body. This pathway is highly significant for PCB's, dioxins, mercury and other chemicals that dissolve in fat. Of course other compounds also pass to the fetus (alcohol,

cigarette products, drugs), but are not the central point here. In cases of long-term exposure to toxic compounds, these can build up in the mother's body and be passed to the fetus in cases where the landfill is a source for residential exposures.

DEQ has expressed concerns over using these studies as they relate to risks from hazardous waste sites and hazardous waste landfills. This study concerns mostly SW (solid wastes), and while many of the substances may be present in modern SW landfills, some of them are banned and are likely to be found only in the older landfills. Thus, some of these risks are greater at older, pre-regulation landfills and waste sites or where wastes are not properly screened.

However, as reported by the Washington Post in a series on landfills and out-of-state waste published November 12-14, 1998, within the huge amounts of waste being disposed of within Virginia – medical wastes and other illegal hazardous wastes can and have been repeatedly disposed of in newer Virginia landfills within loads of routine trash, according to state and county records. As noted in testimony by DEQ director Robert Burnley to the Senate Committee on Environment and Public Works, Virginia bans some types of waste that are acceptable in the municipal solid waste in other states, exacerbating the problem of illegal wastes being disposed of in Virginia landfills. This problem is further exacerbated by the inability to adequately screen or inspect the huge volumes of waste arriving from out-of-state. (See Appendix D, Statement of Robert G. Burnley, Director, Virginia Department of Environmental Quality before the Senate Committee on Environment and Public Works, March 20, 2002)

According to the Washington Post articles, state records show that untreated syringes, tubes with blood, even red bags with biohazard symbols repeatedly have arrived from New York City at the Gloucester and Sussex mega-fills, and at Brunswick from Durham, NC. At other sites, state records show a low-level radioactive device was buried, as were more than 10 tons of hazardous lead paint waste. At Gloucester, DEQ records show that biohazard bags were spotted at least 50 times in 1997, with instances also occurring Amelia, Charles City, King and Queen, and King George counties.

The Post article further reported that "State inspectors visit sites at least once every three months, but Virginia does not require constant monitoring. In May 1992, William W. Hill, chief of enforcement for the Delaware Department of Natural Resources and Environmental Control, notified Virginia that during roadside inspections, his staff noticed that a "large number" of haulers en route from Philadelphia to Charles City carried asbestos and medical waste, according to a letter on file in Richmond." "They are cocktailing the stuff," Hill said, referring to the practice of mixing hazardous medical waste with routine trash. Hill stated he was disappointed when Virginia officials failed to get back to him.

Cleanup and Closure

Landfill Closure

Landfills are planned to have an operating life and capacity, designated in the permit. At the end of normal operations, the landfill is closed and monitoring continues for some period designated in the permit, according to state regulations and operating conditions. Both the closing of the facility and the continued monitoring cost the owner/operator an amount that depends on the work to be done.

Closing a landfill, termed “closure”, requires making the facility stable, not a source of pollutants, and not an eyesore in the area. Basically the steps are to seal the waste off so that it can decompose while the gases and liquids are collected and the surrounding area monitored to ensure safety.

The following basic steps are usual closure procedures:

- o Placing a final layer of material such as clay, to cover and create the proper contour;
- o Installing a surface liner, such as clay or heavy gauge plastic;
- o Installing some structures to actively collect or passively vent (and perhaps burn) the gases produced by the landfill waste decomposition;
- o Covering the landfill with topsoil and grass.

Once the landfill is closed, the groundwater wells and air pipes are monitored quarterly or semi-annually for 10 or 30 years (depending on the type of facility) after the facility ceases to accept waste. The monitoring is to confirm that the gases are not explosive, and that the groundwater, as monitored via the existing well system, is not contaminated. If contamination has already been detected prior to closing, the monitoring is to ensure that GPS's are not exceeded or the remediation plan is working. The groundwater monitoring well system also tracks the direction and velocity of groundwater flow. The basic activities of post-closure and monitoring are:

- o Site inspections of the facility;
- o Sampling groundwater quarterly or semi-annually;
- o Chemical analysis of groundwater and air samples;
- o Maintenance of the landfill cap;
- o Report preparation.

Hazardous waste and municipal waste landfills go through similar basic steps, though the requirements differ as to sampling, monitoring periods, etc. Data in the DEQ files on typical closure costs are on the order of about \$30,000 to \$60,000 per acre to close a municipal waste landfill, with the post-closure monitoring of about \$60,000 (\$2,000/yr for 30 yr). The total cost estimate is the sum

of the two costs - closure and post closure monitoring. Larger landfills and those with contamination problems will have higher costs.

Hazardous waste landfills are more expensive to operate, close and monitor. Sample post closure costs for hazardous waste landfills in the DEQ files include:

Costs Time period

\$1.937 million 16 years

\$306,100 19 years

\$780,000 30 years

(Costs are for first time period and increment cost for subsequent time period.)

The costs vary by size, number of wells and length of time over which the monitoring will be conducted.

Closure and cleanup costs of permitted landfills

The 265 permitted landfills include 47 older publicly owned landfills that do not comply with current standards to protect surface and groundwater. These are known as the 1205 landfills (Table 1). Contamination has been detected in monitoring wells in 32 of these landfills that are among the 164 permitted landfills showing such contamination. According to DEQ, there has been no financial analysis of the list provided in Tables 1 and 2, and no reports completed concerning the information. No cost estimates are available for remediating these permitted landfills. Nor has funding been identified for the oversight tasks assigned to DEQ. The permitted landfills all have operators and/or owners that have assured their financial capability to close and monitor the facility. The problem is that remediation of contaminated groundwater may incur costs that have not been anticipated and the owners/operators may not be able to pay the greater costs; some owners/operators are localities that are now financially stretched.

Using the lowest estimates from the Ogden report for a cleanup cost of \$277 million for 371 sites gives an average low cleanup cost of \$750,000 per facility. Using the Ogden report's highest cleanup estimates of \$670 million for 411 sites gives an average high cleanup cost of \$1.4 million per facility. If one assumes that all the 164 landfills in Table 1 that are in Assessment or Phase II will need cleanup, then the cleanup costs using the previous low and high averages of the Ogden report give a cleanup cost for permitted landfills ranging from \$123 to \$230 million. These costs should be borne by the permit holder, but DEQ has to have the staff and resources to conduct the administrative duties of permit evaluation, site assessments and review and compliance and inspections.

Cleanup of Abandoned Sites

Ogden (1996) provided more complete and comprehensive cost estimates for addressing the abandoned waste sites. Ogden had to estimate the total number of waste sites requiring some sort of cleanup, and costs of such cleanup. The numbers for both components of total costs have surely changed in the six years since the report was completed. Three factors are known to have changed: additional sites where wastes have been mismanaged may have been reported; some of the sites on the original list of 2015 have been cleaned up (DEQ personal communication 9/20/2002) and the costs have increased with inflation, even if modestly. However, the following from Ogden are the best estimates for cleanup that are available without comprehensive evaluation:

No. Sites in database: 2015

No. Actually abandoned 1070

No. Sites with no data 56

No. Low risk sites* 605-645

No. Sites at risk* 371-411

Cost to clean up* \$277- \$670 million

*The range is reported because the threshold for clean up, or acceptable risk level had not been determined and Ogden used two different options for determining which sites need clean up.

The low risk sites are assumed to need little or no cleanup, particularly when compared to the high-risk sites that are more heavily contaminated. The high-risk sites are the ones with considerable contamination of soil and/or groundwater that pose a threat to human health. As noted above, Ogden (1996) used a sample of 250 of the 2015 sites in the database and found that at least 15% (38/250) pose significant risks (see Appendix E, Ogden Risk Assessment Results); at that rate at least 325 sites in Virginia now require cleanup.

The report lists 2015 sites on the “abandoned site” list, but as the Ogden report concluded, many of these are not truly abandoned sites and others do not fall into the category of posing a human health risk. The Ogden investigation also found that there are hundreds of sites around the state with contamination sufficient to pose a significant risk to human health. In order to determine the present conditions, an investigation similar to the one conducted by Ogden would have to be conducted.

The costs estimates from Ogden may only cover a part of the true costs, and may not provide sufficient funding for monitoring and maintenance over the next two or three decades if the sites are more contaminated than estimated. This situation is a realistic possibility for the 56 sites for which there were insufficient data to make a risk estimate. Without further data, there is no way to estimate if these sites are already cleaned up under some existing program or authority, or are highly contaminated and likely to cost millions each to clean up.

DEQ also conducted a business/product sector analysis which assumes that none of the "uncertain risk" sites require remediation. Under this alternative approach, the number of at-risk (highest risk) sites is estimated at 230, and the cost of their remediation is estimated at \$201.19 million. By excluding consideration of sites for which risk could not be assessed due to limited access, or time constraints, DEQ noted that this approach could underestimate remedial costs by up to \$83 million. To summarize, Ogden's final report and DEQ's subsequent sector analyses produced estimates of the number of abandoned at-risk sites in Virginia ranging from 230 to 441. The corresponding remediation costs ranges from \$201.19 million to \$670 million.

Summary and Recommendations

Solid waste is presently handled at nearly 1000 different permitted sites in the state of Virginia; more than twice that many old waste sites (2169) are on the abandoned list. In total, DEQ lists more than 3000 waste sites across the state, and the largest number of these are waste handling facilities (e.g., permitted transfer stations) or abandoned small sites that present little or no risk to public health or the environment. Unfortunately, many contaminated sites remain, either as permitted landfills or as abandoned waste sites (old industrial sites, dumps, and other sites).

Virginia has at least 164 permitted landfills with groundwater contamination on site, and at 48 of these landfills the landfill has been established as the source of contamination. Staffing and administrative resource restrictions limit the timely assessment of landfills by DEQ staff. Although the current permit program requires the permit holder to assure that finances are available to close, maintain and monitor the permitted landfills and to implement corrective action measures, back-up funds are not available if the permit holders do not comply.

The abandoned waste sites were assessed in a report requested by the General Assembly (Ogden, 1996) to estimate the risks and costs of cleaning up the abandoned waste sites. The Ogden report estimated that 18.4 to 23.2 % of the waste sites (2015 in 1995) required clean up, depending on the standards used to assess the sites. If these percentages are valid now, then 400-503 of the 2169 abandoned waste sites in the DEQ database will require cleanup. The cleanup costs were estimated at \$277-670 million six years ago and no update has been conducted.

Landfills pose risks to human health via groundwater contamination, emissions of toxic chemicals into the air and exposure to contaminated soil. The first two are by far the greatest threats to human health. Health and emissions investigations conducted in other places have found that landfills do serve as sources of toxic chemicals and that health effects are caused by landfills that leak or emit toxic chemicals and/or pathogens.

The Commonwealth needs to undertake the following activities in order to understand the magnitude of the problem of solid waste as contaminant in Virginia and then take appropriate action to protect the environment and public health.

- 1) Conduct a file investigation to determine the number of abandoned and permitted waste facilities that are contaminated, and those that require additional soil and water sampling;
- 2) Conduct field investigations to confirm the results of the file investigation and to obtain samples for assessing contamination of sites that presently have no data;

- 3) Obtain cost estimates for cleanup, closure, remediation of the contaminated waste sites identified above;
- 4) Appropriate, allocate, raise funds necessary to close, cleanup, remediate the contaminated waste sites in the state.
- 5) Publish and make available on-line monitoring data and reports.
- 6) Publish and make available on-line a list of locations of the contaminated waste sites in the state, with the risk ranking. In cases where the ranking is uncertain, the state needs to err on the side of public health protection and classify unknown sites as high risk.

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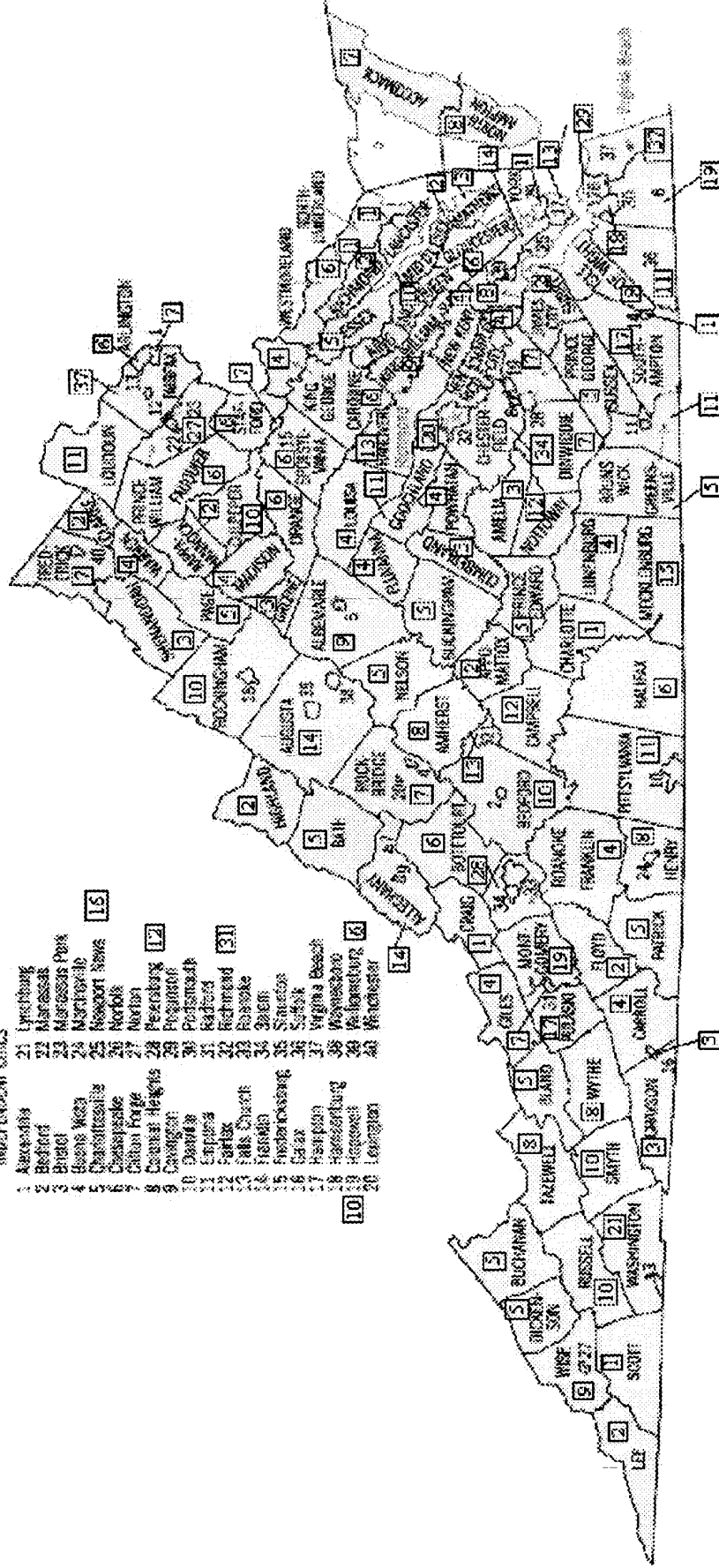
Appendices

Appendix A	Abandonment of Kim-Stan Landfill Experience
Appendix B	Executive Summary of House Document 85, The Appropriate Role and Responsibility, If Any, To Assist Localities in Remediating Abandoned Solid or Hazardous Waste Sites
Appendix C	East Richmond Landfill Report
Appendix D	Statement of Robert G. Burnley, Director, Virginia Department of Environmental Quality, before the Senate Committee on Environment and Public Works, March 20, 2002
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Permitted Waste Sites in Virginia

INDEPENDENT CITIES

- 1 Alexandria
- 2 Bedford
- 3 Bristol
- 4 Buena Vista
- 5 Charlottesville
- 6 Chesapeake
- 7 Colonial Forge
- 8 Colonial Heights
- 9 Covington
- 10 Danville
- 11 Emporia
- 12 Fairfax
- 13 Falls Church
- 14 Fredericksburg
- 15 Galax
- 16 Harrison
- 17 Harrisonburg
- 18 Haymarket
- 19 Hopewell
- 20 Lexington
- 21 Lynchburg
- 22 Manassas
- 23 Manassas Park
- 24 Martinsburg
- 25 Newport News
- 26 Norfolk
- 27 Norton
- 28 Petersburg
- 29 Prosserstown
- 30 Radford
- 31 Radford
- 32 Richmond
- 33 Roanoke
- 34 Salem
- 35 Staunton
- 36 Suffolk
- 37 Virginia Beach
- 38 Waynesboro
- 39 Williamsburg
- 40 Winchester



http://quickfacts.census.gov/qtd/maps/Virginia_map.html

Figure 1. Permitted waste sites in Virginia

INDEPENDENT CITIES

1	Alexandria
2	Bedford
3	Bristol
4	Byrd
5	Charlottesville
6	Chesapeake
7	Civil War
8	Creston Heights
9	Crofton
10	Danville
11	Fairfax
12	Farmington
13	Farmington
14	Farmington
15	Farmington
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95	Farmington

Figure 2. Abandoned waste sites in Virginia

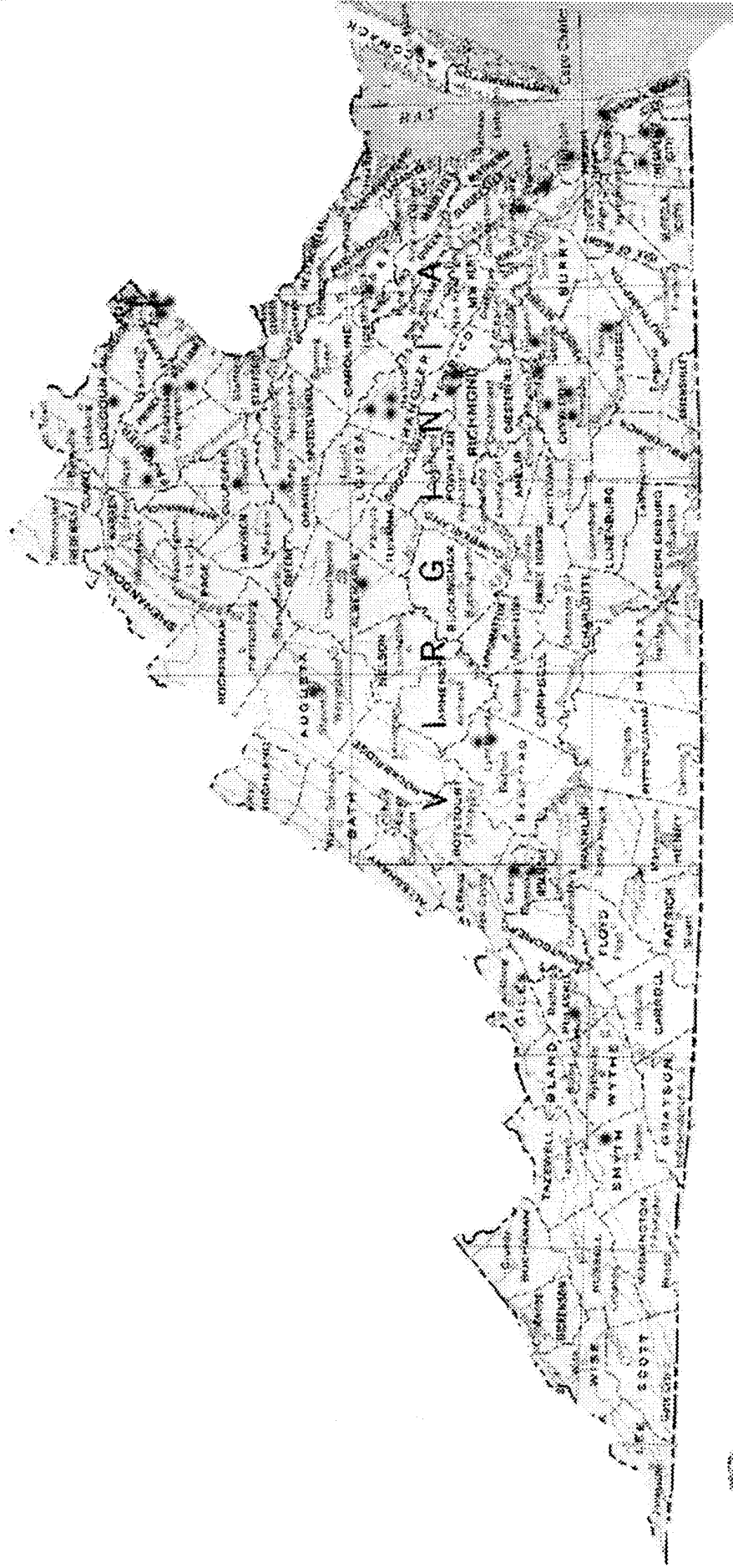


Figure 3. Highest risk sites, Ogden Report 1996

Table 1	Landfills in Virginia.												
Permit #	Facility	Region	Type	GW Req'd	Staff	1205 facility	Active SLF*	GW program	MW system OK	GPS Req'd	GPS Estab.	GPS SSI	
1	LOUDOUN CO	NRO	S	Y	MW	yes	U	Assessment	Yes	Yes	Yes	Yes	
5	KING GEORGE (old)	NRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
8	EI DUPONT	WCRO	S	Y	RB	-	-	Phase II	Yes	Yes	No	NA	
12	CITY OF FRANKLIN	TRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	YES	NO	
14	MECKLENBURG CO	PRO	S	Y	JB	yes	U	assessment	yes	yes	no	no	
20	MIDDLESEX CO	PRO	S	Y	RB	-	-	Assessment	No	Yes	No	NA	
21	AUGUSTA CO SVC AUTH	VRO	S	Y	RB	Yes	U	Detection	No	No	NA	NA	
23	SCOTT CO	SWRO	S	Y	RB	Yes	U	Assessment	No	Yes	No	NA	
27	LEE CO-JONESVILLE DIST	SWRO	S	Y	RC	-	-	DETECTION	NO	NO	NO	NO	
29	INDEPENDENT HILL-PR WILLIAM	NRO	S	Y	RB	Yes	C	Assessment	Yes	Yes	Yes	Yes	
30	BEDFORD CO	WCRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes	
31	SOUTH BOSTON	PRO	S	Y	LWS	Yes	U	Assessment	Yes	Yes	Yes	Yes	
32	CITY OF FREDERICKSBURG	NRO	S	Y	LWS	-	-	Assessment	Yes	Yes	No	No	
34	GLOUCESTER CO	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No	
38	MONTGOMERY CO	WCRO	S	Y	LWS	-	-	Assessment	Yes	Yes	No	No	
41	CRANEY ISLAND	TRO	D	Y	RC	-	-	DETECTION	YES	NO	N/A	N/A	
44	WAKEFIELD	PRO	S	Y	JB	-	-	Assessment	yes	no	no	no	
49	CITY OF MARTINSVILLE	WCRO	S	Y	GXC	YES	U	ASSESSMENT	YES	YES	NO	N/A	
59	CITY OF HARRISONBURG	VRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
62	ROCKINGHAM CO	VRO	S	Y	LWS	Yes	C	Assessment	Yes	Yes	Yes	Yes	
65	FIRST PIEDMONT - PARTITION A	WCRO	I	Y	RC	-	-	PHASE II	YES	YES	YES	YES	
65	FIRST PIEDMONT - PARTITION B	WCRO	I	Y	RC	-	-	PHASE I	YES	N/A	N/A	N/A	
67	GALAX	SWRO	S	Y	GXC	-	-	ASSESSMENT	YES	NO	N/A	N/A	
70	PATRICK CO	WCRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes	
72	FRANKLIN CO	WCRO	S	Y	RB	yes	U	Assessment	Yes	Yes	No	NA	
74	STAFFORD CO	NRO	S	Y	LWS	-	-	Assessment	No	Yes	No	No	
75	ROCKBRIDGE CO-BUENA VISTA	VRO	S	Y	RC	YES	U	DETECTION	YES	NO	N/A	N/A	
86	APPOMATTOX CO	WCRO	S	Y	JB	yes	U	Assessment	yes	yes	as of 12/30/01	n/a	
87	ISLE OF WIGHT CO	TRO	S	Y	JB	-	-	Assessment	yes	yes	as of 12/30/01	n/a	
88	FLOYD CO	WCRO	S	Y	JB	-	-	Assessment	yes	yes	yes	yes	
89	PAGE CO	VRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
90	ORANGE CO	NRO	S	Y	LWS	Yes	U	Assessment	Yes	Yes	Yes	Yes	
91	ACCOMACK CO -BOBTOWN SOUTH	TRO	S	Y	JB	yes	U	Assessment	yes	yes	as of 12/30/01	n/a	
92	HALIFAX CO	PRO	S	Y	LWS	Yes	C	Assessment	Yes	Yes	Yes	Yes	
93	HERCULES INC	WCRO	I	Y	LWS	-	-	Phase II	Yes	Yes	Yes	No	
96	JAMES CITY CO [see #351]	TRO	S	Y	JB	-	-	see 351					
100	SPOTSYLVANIA - BERKELEY CDD	NRO	D	Y	LWS	-	-	Phase II	Yes	Yes	Yes	Yes	
101	CHARLOTTE CO	PRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
102	CHARLES CITY CO	PRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
103	I-95	NRO	S	Y	MW	yes	C	Assessment	Yes	Yes	Yes	No	
105	WYTHE CO	SWRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes	
107	SUSSEX CO-ROBINSON ROAD	PRO	S	Y	RC	-	-	ASSESSMENT	YES	YES	NO	N/A	
108	CRAIG COUNTY	WCRO	S	Y	RC	-	-	DETECTION	YES	NO	N/A	N/A	
109	VPI & SU	WCRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
110	DINWIDDIE CO	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No	
113	BRUNSWICK CO	PRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
116	TAZEWELL CO - BALL	SWRO	S	N	GXC	-	-	DETECTION	YES	NO	N/A	N/A	
122	CITY OF DANVILLE	WCRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
125	IVY LANDFILL	VRO	S	Y	JB	-	-	Assessment	yes	yes	yes	yes	
126	ALBEMARLE CO-KEENE	VRO	S	Y	JB	-	-	Assessment	yes	yes	yes	no	
129	BFI - CHARLES CITY ROAD	PRO	S	Y	GXC	-	-	ASSESSMENT	YES	NO	N/A	N/A	
131	GILES CO	WCRO	S	Y	LWS	-	-	Assessment	Yes	Yes	No	No	
142	BATH CO	VRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	
149	FAUQUIER CO	NRO	S	Y	JB	yes	U	Assessment	yes	yes	yes	yes	
151	ACCOMACK CO-NORTH #1	TRO	S	N	JB	-	-	Assessment	unk	unk	no		
153	KING WILLIAM CO	PRO	S	Y	JB	-	-	Assessment	no	yes	as of 12/01	n/a	
157	WISE CO-APPALACHIA	SWRO	S	Y	GXC	-	-	DETECTION	YES	NO	N/A	N/A	
158	PRINCE GEORGE CO	PRO	S	Y	RB	-	-	Assessment	No	Yes	No	NA	
164	HERCULES INC-PULASKI CO	WCRO	I	Y	RB	-	-	Phase II	Yes	No	NA	NA	
165	ROANOKE VALLEY	WCRO	S	Y	MW	-	-	Assessment	Yes	Yes	No	No	
167	ESSEX CO	PRO	S	Y	JB	-	-	Assessment	no	yes	no		
173	WILLIE COSBY	PRO	D	Y	RC	-	-	PHASE II	YES	YES	NO	N/A	
174	MATHEWS CO	PRO	S	Y	RC	-	-	ASSESSMENT	NO	YES	NO	N/A	
175	TRI-COUNTY	PRO	S	Y	RC	-	-	ASSESSMENT	YES	YES	NO	N/A	
177	MONTGOMERY CO - MID-COUNTY	WCRO	S	N	RB	-	-	Assessment	Establishing MWs	Yes	No	NA	
178	COVINGTON-PETERS MTN	WCRO	S	Y	RB	-	-	see 594	see 594	see 594	see 594	see 594	
179	GOOCHLAND CO	PRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A	

Permit #	Facility	Region	Type	GW Req'd	Staff	1205 facility	Active SLF*	GW program	MW system OK	GPS Req'd	GPS Estab.	GPS SSI
181	AMHERST CO	WCRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	YES	NO
182	CAROLINE CO	NRO	S	Y	LWS	Yes	U	Assessment	Yes	Yes	Yes	Yes
183	MERCK	VRO	I	Y	MW	-	-	Assessment	Yes	Yes	Yes	Yes
184	WARREN CO	VRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	YES	YES
187	EI DUPONT-WAYNESBORO NURSERIES	VRO	I	Y	RB	-	-	Phase II	Yes	Yes	No	NA
188	M & M WRECKING [see #525]	PRO	S	N	JB	-	-	See #525				
193	SUSSEX CO - GIN HILL	PRO	S	Y	RC	-	-	ASSESSMENT	YES	YES	NO	N/A
194	LOUISA CO	VRO	S	Y	JB	yes	U	Assessment	in question	yes	as of 12/01	
195	TOWN OF FARMVILLE	PRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A
196	CITY OF BEDFORD	WCRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A
198	GEORGIA PACIFIC - BEDFORD	WCRO	I	Y	RC	-	-	PHASE II	YES	YES	NO	N/A
201	CITY OF HOPEWELL	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No
204	WAYNESBORO CITY	VRO	S	Y	LWS	Yes	U	Assessment	Yes	Yes	Yes	Yes
205	BLAND CO - DEHART	SWRO	S	Y	RC	-	-	DETECTION	YES	NO	N/A	N/A
207	HOECHST-CELANESE FIBERS	WCRO	I	Y	RC	-	-	PHASE II	YES	NO	N/A	N/A
208	HIGHLAND CO	VRO	S	Y	JB	-	-	Assessment	yes	yes	yes	no
218	BUCHANAN CO	SWRO	S	Y	MW	-	-	Detection	Yes	No	No	No
222	APPALACHIAN PWR - GLEN LYN	WCRO	I	Y	RB	-	-	Phase II	Yes	No	NA	NA
223	APPLACHIAN POWER CLINCH RIVER	SWRO	I	Y	RB	-	-	Phase II	Yes	Yes	No	NA
227	LUNENBURG CO	PRO	S	Y	JB	yes	U	Assessment	yes	yes	as of 12/01	
228	CITY OF PETERSBURG	PRO	S	Y	MW	Yes	C	Assessment	Yes	Yes	No	No
229	PULASKI CO - CLOYDS MTN	WCRO	S	Y	MW	-	-	Assessment	Yes	Yes	No	No
233	HOOVER COLOR CORP	WCRO	I	Y	JB	-	-	phase I	yes	no		
235	COX - CHARLES CITY ROAD	PRO	D	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A
246	HENRICO CO #3	PRO	S	Y	JB	-	-	Assessment	in process	yes	as of 12/01	
247	NOTTOWAY CO	PRO	S	Y	LWS	-	-	See #304				
249	KING & QUEEN CO-MASCOT	PRO	S	Y	RB	-	-	Assessment	Yes	Yes	No	NA
251	LAUREL VALLEY - CULPEPER CO	NRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes
253	KING & QUEEN CO-OWENTON	PRO	S	Y	RB	-	-	Assessment	No	Yes	No	NA
255	CHESAPEAKE - MANN LF #2	PRO	I	Y	GXC	-	-	PHASE II	NO	NO	N/A	N/A
258	RUSSELL CO LF-COPPER RIDGE	SWRO	S	Y	GXC	-	-	ASSESSMENT	YES	NO	N/A	N/A
261	DICKENSON CO	SWRO	S	Y	RC	-	-	DETECTION	YES	NO	N/A	N/A
263	WARREN BORROW PIT	TRO	D	Y	LWS	-	-	Phase II	Yes	Yes	No	No
266	GREENE CO	VRO	S	Y	JB	-	-	Assessment	in question	yes	no	
270	TAYLOR RD	PRO	D	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
273	LYNCHBURG CITY [see #558]	WCRO	S	N	JB	-	-	See #558				
274	SURRY CO	PRO	S	Y	MW	-	-	Assessment	Yes	Yes	No	No
275	CAMP PEARY	TRO	S	Y	JB	-	-	phase I	yes	no		
278	OCEANA NAVAL AIR STN	TRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No
280	HOLLAND LF-SUFFOLK	TRO	I	Y	JB	-	-	phase I	yes	no		
283	SOUTH HILL	PRO	D	Y	GXC	-	-	PHASE II	YES	NO	N/A	N/A
285	CAMPBELL CO (PHASE II)	WCRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No
285	CAMPBELL CO (PHASE III)	WCRO	S	Y	LWS	Yes	C	Detection	Yes	No	No	No
288	FEDERAL CORRECTIONAL CTR	PRO	D	Y	RB	-	-	Phase II	Yes	No	NA	NA
289	FT EUSTIS	TRO	S	Y	RC	-	-	DETECTION	YES	NO	N/A	N/A
298	YORK CO #2	TRO	S	Y	RC	-	-	ASSESSMENT	NO	YES	NO	N/A
300	WYTHEVILLE TOWN	SWRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes
304	NOTTOWAY CO (NEW)	PRO	S	Y	LWS	Yes	C	Detection	Yes	No	No	No
304	NOTTOWAY CO (OLD)	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	No	No
305	THRASHER	TRO	D	Y	RB	-	-	Phase II	Yes	Yes	No	NA
307	US GYPSUM -WASHINGTON CO	SWRO	I	Y	MW	-	-	Phase II	Yes	Yes	No	No
308	FT BELVOIR LF (CULLUM WOODS)	NRO	S	Y	JB	-	-	Assessment	yes	yes	yes	no
310	SUFFOLK CITY - HOZIER RD	TRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes
312	DIXON LUMBER MONOFILL	SWRO	I	Y	GXC	-	-	PHASE I	YES	NO	N/A	N/A
314	HANOVER CO - 301	PRO	S	Y	JB	yes	U	Assessment	yes	yes	yes	yes
316	WESTMORELAND CO	PRO	S	Y	RB	-	-	Assessment	No	No	NA	NA
317	CRIPPEN STUMP DUMP	NRO	D	Y	GXC	-	-	PHASE II	YES	YES	NO	N/A
318	CHESTERFIELD - NORTHERN AREA	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No
319	BOTETOURT CO	WCRO	S	Y	MW	-	-	Assessment	Yes	Yes	No	No
320	HENRY CO	WCRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes
322	WALTRIP	TRO	D	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
326	HILLTOP	NRO	D	Y	RC	-	-	PHASE II	YES	NO	N/A	N/A
327	RAINWATER	NRO	D	Y	JB	-	-	phase II	yes	yes	yes	yes
328	NELSON CO	VRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes
329	COLLEGE OF WILLIAM AND MARY	TRO	D	Y	JB	-	-	phase I	yes	no		
330	FEW INC CDD	TRO	D	Y	RB	-	-	Phase I	Install MWs	No	No	No
331	LORTON CDD	NRO	D	Y	MW	-	-	Phase I	Yes	No	No	No
332	FT AP HILL	NRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes
333	FT PICKETT	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No

Permit #	Facility	Region	Type	GW Req'd	Staff	1205 facility	Active SLF*	GW program	MW system OK	GPS Req'd	GPS Estab.	GPS SSI
339	CARTERSVILLE	PRO	S	Y	MW	-	-	Assessment	Yes	Yes	No	No
341	RANDOLFPH DIST	PRO	S	Y	JB	-	-	Assessment	yes	yes	yes	no
342	MADISON DIST	PRO	S	Y	JB	-	-	Assessment	yes	yes	yes	no
343	VIRECO	PRO	I	Y	JB	-	-	phase I	yes	no		
346	GA PACIFIC NORTH-JARRATT	PRO	I	Y	RB	-	-	Phase I	Yes	No	NA	NA
350	AMELIA CO	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	Yes
351	JAMES CITY CO	TRO	S	Y	JB	-	-	Assessment	in question	yes	yes	no
353	RADFORD ARMY AMMO PLT ASH #2	WCRO	I	Y	RC	-	-	PHASE II	YES	YES	NO	N/A
354	DAHLGREN'S CORNER	PRO	S	Y	JB	-	-	Assessment	yes	yes	no	
358	CITY OF SALEM	WCRO	S	Y	RB	-	-	Assessment	Yes	No	NA	NA
362	SALEM VA HOSPITAL	WCRO	I	Y	RC	-	-	PHASE II	YES	YES	NO	N/A
363	AMOCO -YORKTOWN REFINERY	TRO	I	Y	RC	-	-	PHASE II	YES	YES	NO	N/A
364	BAILLIO CDD	TRO	D	Y	GXC	-	-	PHASE 1	YES	NO	N/A	N/A
368	BRAITHWAITE CDD	TRO	D	Y	GXC	-	-	PHASE 1	YES	NO	N/A	N/A
377	SHOOSMITH	PRO	D	Y	RB	-	-	Phase I	Yes	No	NA	NA
381	SMYTH CO-PORTER FIELD	SWRO	S	Y	JB	-	-	Assessment	yes	yes	yes	yes
384	GUNTER CDD	TRO	D	Y	LWS	-	-	Phase I	Yes	No	No	No
385	MURRAY BORROW PIT	TRO	D	Y	LWS	-	-	Phase II	Yes	Yes	Yes	No
386	NEWPORT NEWS #2	TRO	S	Y	LWS	-	-	Detection	Yes	No	No	No
394	WESTVACO FLY ASH #3	WCRO	D	Y	GXC	-	-	DETECTION	YES	NO	N/A	N/A
397	MID-COUNTY LF	WCRO	S	Y	RB	Yes	U	Detection	Yes	No	NA	NA
398	VA BEACH LF #2-MT TRSHMR II	TRO	S	Y	RB	Yes	C	Assessment	Yes	Yes	No	NA
404	CAMPOSTELLA CDD	TRO	D	Y	RC	-	-	PHASE II	YES	YES	NO	N/A
405	GREENVILLE CO LF	PRO	S	Y	LWS	Yes	C	Assessment	Yes	Yes	No	No
406	WASHINGTON CO LF	SWRO	S	Y	RC	-	-	DETECTION	YES	NO	N/A	N/A
411	QUANTICO LF	NRO	S	Y	RB	-	-	Assessment	Yes	Yes	No	NA
413	WESTVACO FLY ASH #1	WCRO	I	Y	GXC	-	-	DETECTION	YES	NO	N/A	N/A
414	WESTVACO FLY ASH #2	WCRO	I	Y	GXC	-	-	DETECTION	YES	NO	N/A	N/A
415	GRAFTON MATERIALS	TRO	D	Y	GXC	-	-	PHASE II	YES	YES	NO	N/A
417	SPSA REGIONAL LF	TRO	S	Y	MW	Yes	C	Assessment	Yes	Yes	No	No
420	PRINCE EDWARD CO SLF	PRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A
424	GA PACIFIC ASH FILL-EMPORIA	PRO	I	Y	RB	-	-	Phase II	No	Yes	No	NA
426	NORTH ANNA FLY ASH MONOFILL	PRO	I	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
429	FLUVANNA CO SLF	VRO	S	Y	GXC	YES	U	DETECTION	NO	NO	N/A	N/A
433	RADFORD ARMY AMMO PLT CDD	WCRO	D	Y	RC	-	-	PHASE II	YES	YES	NO	N/A
436	WOLFTRAP CDD	TRO	D	Y	JB	-	-	phase I	yes	no		
440	VA POWER ASH FILL	TRO	I	Y	RB	-	-	Phase II	Yes	Yes	No	NA
441	POTOMAC CDD LF	NRO	D	Y	JB	-	-	phase II	yes	yes	yes	no
445	THOMAS BROS CDD	WCRO	D	Y	GXC	-	-	PHASE II	NO	YES	NO	N/A
451	INDIAN TRAIL CDD LF	TRO	D	Y	GXC	-	-	PHASE I	YES	NO	N/A	N/A
452	TOWN OF CHRISTIANBURG LF	WCRO	S	Y	GXC	-	-	ASSESSMENT	YES	YES	NO	N/A
453	FT LEE CDD LF	PRO	D	Y	RC	-	-	PHASE II	YES	NO	N/A	N/A
456	LYNCHBURG FOUNDRY-LYNCHBURG	WCRO	I	Y	RB	-	-	Phase II	Yes	No	NA	NA
457	VA POWER FLY ASH-YORK CO	TRO	I	Y	RB	-	-	Phase II	Yes	No	NA	NA
459	GRAYSON CO LF	SWRO	S	Y	RC	-	-	DETECTION	NO	NO	N/A	N/A
461	ACCOMACK CO LF #2	TRO	S	Y	JB	yes	C	Detection	yes	No	No	No
469	SHENANDOAH CO SLF	VRO	S	Y	JB	yes	U	Assessment	yes	yes	yes	yes
470	EMPORIA FOUNDRY LF	PRO	I	Y	RB	-	-	Phase II	Yes	No	NA	NA
471	CRIPPEN IND WASTE LF	PRO	I	Y	LWS	-	-	Phase II	Yes	Yes	No	No
490	FT BELVOIR THEOTE RD	NRO	D	Y	JB	-	-	phase I	yes	no		
493	HIGGERSON-BUCHANAN	TRO	D	Y	LWS	-	-	Phase II	Yes	No	No	No
498	BRISTOL CITY LF [see #500]	SWRO	S	Y	MW	-	-	Assessment	Yes	Yes	No	No
500	BRISTOL CDD (see #498)	SWRO	D	Y	MW	-	-	See #498				
503	SPOTSYLVANIA CO - CHANCELLOR	NRO	S	Y	LWS	-	-	Assessment	Yes	Yes	Yes	No
504	UNION CAMP LF #2	TRO	I	Y	RC	-	-	PHASE II	YES	NO	N/A	N/A
505	KING WILLIAM CO LF	PRO	S	Y	LWS	-	-	Assessment	Yes	Yes	No	No
506	623 CDD LF	PRO	D	Y	RB	-	-	Phase I	Yes	NA	NA	NA
507	NORTHAMPTON CO LF-OYSTER SITE	TRO	S	Y	JB	yes	U	Assessment	yes	yes	as of 12/01	
508	CARROLL CO LF - FING PROPERTY	SWRO	S	Y	GXC	Yes	C	DETECTION	YES	NO	N/A	N/A
511	ROCK-TENN CORP	WCRO	I	Y	JB	-	-	phase I	yes	no		
513	WISE CO - BLACKWOOD LF	SWRO	S	Y	GXC	YES	U	DETECTION	YES	NO	N/A	N/A
514	TARMAC-LONESTAR LF	WCRO	I	Y	LWS	-	-	Phase II	Yes	Yes	Yes	No
515	RUSSELL CO LF	SWRO	S	Y	GXC	-	-	DETECTION	YES	NO	N/A	N/A
516	QUALLA RD CDD LF	PRO	D	Y	RB	-	-	Phase I	Yes	NA	NA	NA
517	LYNCHBURG FOUNDRY-FALWELL	WCRO	I	Y	LWS	-	-	Phase II	Yes	Yes	No	No
519	BOTETOURT CO SLF (see #319)	WCRO	S	Y	MW	-	-	See #319				
520	RAPPAHANNOCK CO LF	NRO	S	Y	RC	Yes	C	DETECTION	YES	NO	N/A	N/A
521	BIG BETHEL LF	TRO	S	Y	MW	-	-	Detection	Yes	No	No	No
522	WESTVACO ASBESTOS LF	WCRO	I	Y	GXC	-	-	PHASE I	YES	NO	N/A	N/A

Permit #	Facility	Region	Type	GW Req'd	Staff	1205 facility	Active SLF*	GW program	MW system OK	GPS Req'd	GPS Estab.	GPS SSI
524	SIMONS HAULING CDD	PRO	D	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
525	COX CDD	PRO	D	Y	JB	-	-	phase II	yes	yes	no	
526	NRRA-INGELS MTN CDD	WCRO	D	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
527	ABEX CORP LF	VRO	I	Y	MW	-	-	Phase I	Yes	No	No	No
528	BEAR ISLAND PAPER CO [see #573]	PRO	I	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
529	FREDERICK CO LF	VRO	S	Y	MW	-	D	Detection	Yes	No	No	No
531	USA WASTE - CHARLES CITY	PRO	S	Y	RC	-	D	DETECTION	YES	NO	N/A	N/A
535	NRRA INTERIM LANDFILL	WCRO	S	Y	JB	-	-	DETECTION	redoing	No	No	No
536	VA FIBRE LANDFILL (Grief Bros.)	WCRO	I	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
540	USA WASTE – MAPLEWOOD	PRO	S	Y	RB	-	D	Detection	Yes	NA	NA	NA
542	UPPER OCCOQUAN SEW AUTH	NRO	I	Y	LWS	-	-	Phase I	Yes	No	No	No
543	CHESAPEAKE PAPER - MANN #3	PRO	I	Y	GXC	-	-	Phase II	NO	NO	N/A	N/A
544	LUNENBURG CO LF	PRO	S	N	JB	-	-	Not Built				
545	HENRICO CO - SPRINGFIELD RD	PRO	S	Y	JB	Yes	C	Assessment	reworking	yes	as of 12/01	
547	SPOTSYLVANIA CO - LIVINGSTON #2	NRO	S	Y	LWS	Yes	C	Assessment	Yes	Yes	Yes	Yes
548	NEW RIVER RESOURCE AUTHORITY	WCRO	S	Y	MW	-	D	DETECTION	Yes	No	No	No
549	GEORGIA PACIFIC – AMHERST	WCRO	I	Y	RB	-	-	Phase II	Yes	No	NA	NA
552	SHREDDED PRODUCTS CORP.	WCRO	I	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
553	BFI - OLD DOMINION	PRO	S	Y	MW	-	D	DETECTION	Yes	No	No	No
554	KING & QUEEN	PRO	S	Y	MW	-	D	Detection	Yes	No	No	No
555	SMITH GAP REGIONAL	WCRO	S	Y	RC	-	D	DETECTION	YES	NO	N/A	N/A
556	VA POWER - CLOVER POWER STA	PRO	I	Y	RB	-	-	Phase II	Yes	Yes	No	NA
558	CITY OF LYNCHBURG	WCRO	S	Y	JB	Yes	C	Assessment	yes	yes	yes	no
560	BEDFORD CO LF	WCRO	S	Y	GXC	-	D	DETECTION	YES	NO	N/A	N/A
562	ATLANTIC WASTE	PRO	S	Y	MW	-	D	Detection	Yes	No	No	No
563	AMHERST CO LF	WCRO	S	Y	GXC	-	D	DETECTION	NO	NO	N/A	N/A
564	TAZEWELL CO	SWRO	S	Y	GXC	Yes	C	DETECTION	YES	No	No	No
569	CITY OF BEDFORD - HYLTON LF	WCRO	S	Y	GXC	-	D	DETECTION	YES	NO	N/A	N/A
571	PITTSYLVANIA CO LF	WCRO	S	Y	LWS	Yes	C	Assessment	Yes	Yes	Yes	Yes
572	MIDDLE PENNISULA LF	PRO	S	Y	RB	-	D	Detection	Yes	NA	NA	NA
573	BEAR ISLAND PAPER CO.	PRO	I	Y	RC	-	-	PHASE I	YES	NO	N/A	N/A
574	ASHCAKE CDD LF	PRO	D	Y	RB	-	-	Phase I	Yes	NA	NA	NA
575	FAUQUIER CO - CORRAL FARM LF	NRO	S	Y	GXC	-	D	DETECTION	YES	NO	N/A	N/A
579	PAGE CO - BATTLE CREEK LF	VRO	S	Y	GXC	-	D	DETECTION	YES	NO	N/A	N/A
580	BIG BETHEL LF	TRO	S	Y	MW	Yes	C	Detection	Yes	No	No	No
581	COUNTRY SOUTH	WCRO	D	Y	JB	-	-	phase I	yes	no		
582	BOTETOURT CO LF (see #319)	WCRO	S	Y	MW	Yes	C	Assessment	Yes	Yes	No	No
583	AEGIS WASTE - BRUNSWICK	PRO	S	Y	RC	-	D	DETECTION	YES	NO	N/A	N/A
584	PRINCE EDWARD CO LF	PRO	S	Y	GXC	Yes	C	DETECTION	YES	NO	N/A	N/A
585	AUGUSTA CO - STAUNTON LF #2	VRO	S	Y	RB	-	D	Detection	Yes	NA	NA	NA
586	USA WASTE - KING GEORGE CO	NRO	S	Y	GXC	-	D	DETECTION	YES	NO	N/A	N/A
587	SHOOSMITH BROS. INC	PRO	S	Y	JB	yes	C	Assessment	yes	yes	yes	no
588	BRISTOL QUARRY BALEFILL (see #500)	SWRO	S	Y	MW	Yes	D	Assessment	Yes	Yes	No	No
589	RAPPAHANOCK REGIONAL LF	NRO	S	Y	RC	YES	C	DETECTION	NO	NO	N/A	N/A
590	CULPEPER CO - LAUREL VALLEY	NRO	S	N	LWS	-	-	Detection	Yes	Yes	No	No
591	FREDERICK COUNTY CDD	VRO	D	Y	JB	-	-	phase I	yes	no		
594	PETERS MOUNTAIN	WCRO	S	Y	RB	Yes	C	Detection	Yes	NA	NA	NA
595	WESTVACO INDUSTRIAL #5	WCRO	I	Y	GXC	-	-	NOT REQ'D				
u	COLONIAL HEIGHTS LF	PRO			LWS	-	-	Assessment	Yes	Yes	No	No
u	ENRON	PRO			RC	-	-	PHASE II	YES	NO	N/A	N/A
u	FIELDCREST	WCRO			LWS	-	-	Phase II	Yes	Yes	Yes	No
u	LIESFIELD	PRO			LWS	-	-	Phase I	Yes	No	No	No
u	Marion	SWRO	S	Y	RC	-	-	DETECTION	YES	NO	N/A	N/A
u	MASONITE	WCRO			LWS	-	-	Phase I	yes	No	No	No
u	NORFOLK SOUTHER - PATTERSON AV	WCRO		Y	LWS	-	-	Phase II	Yes	Yes	Yes	No
u	NORTH AMERICAN HOUSING	WCRO	D		RC	-	-	PHASE II	YES	NO	N/A	N/A
u	PECK IRON & METAL	PRO			MW	-	-	Phase II	Yes	Yes	No	No
u	SWEET BRIAN COLLEGE	WCRO			LWS	-	-	Phase I	Yes	No	No	No
u	VA FIBRE - RIVERVILLE	WCRO		C	RC	-	-	PHASE II	YES	NO	N/A	N/A
u	WALKER MANUFACTURING	VRO	D	Y	LWS	-	-	Phase I	yes	No	No	No

Table 2. Landfills which have exceeded or established GPS; from DEQ 9/2002.

Permit #	Facility	Region	Type	1205 facility	Active SLF*	GW program
91	ACCOMACK CO -BOBTOWN SOUTH	TRO	S	yes	U	Assessment
126	ALBEMARLE CO-KEENE	VRO	S	-	-	Assessment
350	AMELIA CO	PRO	S	-	-	Assessment
86	APPOMATTOX CO	WCRO	S	yes	U	Assessment
30	BEDFORD CO	WCRO	S	-	-	Assessment
100	BERKELEY CDD-SPOTSYLVANIA	NRO	D	-	-	Phase II
285	CAMPBELL CO (PHASE II)	WCRO	S	-	-	Assessment
404	CAMPOSTELLA CDD	TRO	D	-	-	PHASE II
182	CAROLINE CO	NRO	S	Yes	U	Assessment
503	CHANCELLOR-- SPOTSYLVANIA CO -	NRO	S	-	-	Assessment
318	CHESTERFIELD - NORTHERN AREA	PRO	S	-	-	Assessment
110	DINWIDDIE CO	PRO	S	-	-	Assessment
149	FAUQUIER CO	NRO	S	yes	U	Assessment
65	FIRST PIEDMONT - PARTITION A	WCRO	I	-	-	PHASE II
88	FLOYD CO	WCRO	S	-	-	Assessment
198	GEORGIA PACIFIC - BEDFORD	WCRO	I	-	-	PHASE II
34	GLOUCESTER CO	PRO	S	-	-	Assessment
405	GREENVILLE CO LF	PRO	S	Yes	C	Assessment
92	HALIFAX CO	PRO	S	Yes	C	Assessment
320	HENRY CO	WCRO	S	-	-	Assessment
93	HERCULES INC	WCRO	I	-	-	Phase II
201	HOPEWELL CITY	PRO	S	-	-	Assessment
103	I-95	NRO	S	yes	C	Assessment
87	ISLE OF WIGHT CO	TRO	S	-	-	Assessment
125	IVY LANDFILL	VRO	S	-	-	Assessment
351	JAMES CITY CO	TRO	S	-	-	Assessment
251	LAUREL VALLEY - CULPEPER CO	NRO	S	-	-	Assessment
1	LOUDOUN CO	NRO	S	yes	U	Assessment
558	LYNCHBURG CITY	WCRO	S	Yes	C	Assessment
328	NELSON CO	VRO	S	-	-	Assessment
90	ORANGE CO	NRO	S	Yes	U	Assessment
70	PATRICK CO	WCRO	S	-	-	Assessment
571	PITTSYLVANIA CO LF	WCRO	S	Yes	C	Assessment
62	ROCKINGHAM CO	VRO	S	Yes	C	Assessment
31	SOUTH BOSTON	PRO	S	Yes	U	Assessment
547	SPOTSYLVANIA CO - LIVINGSTON #2	NRO	S	Yes	C	Assessment
310	SUFFOLK CITY - HOZIER RD	TRO	S	-	-	Assessment
514	TARMAC-LONESTAR LF	WCRO	I	-	-	Phase II
175	TRI-COUNTY	PRO	S	-	-	Assessment
332	US ARMY FT AP HILL	NRO	S	-	-	Assessment
333	US ARMY FT PICKETT	PRO	S	-	-	Assessment
278	US NAVY OCEANA NAS	TRO	S	-	-	Assessment
204	WAYNESBORO CITY	VRO	S	Yes	U	Assessment
471	WEAVER IND WASTE LF	PRO	I	-	-	Phase II
385	WILLIAMS CORP DEBRIS LF-VA BCH	TRO	D	-	-	Phase II
263	WILLIAMS LF-ARMISTEAD AV	TRO	D	-	-	Phase II
105	WYTHE CO	SWRO	S	-	-	Assessment
300	WYTHEVILLE TOWN	SWRO	S	-	-	Assessment

Groundwater contamination detected and monitoring is required in all landfills. Monitoring wells are in place and GPS established for all facilities on this list.

Landfill type: S= sanitary; D= debris; I= Industrial

Table 3. Toxicity of Landfill Gases Reported by California in a 1990 survey of landfill gase.

Chemical	Health Risk	Source	Standard	Reference
Vinyl Chloride	<p>Inhalation - dizziness; headache; damage to the lungs, liver, and kidneys (high levels, animals); heart and blood clotting problems (high levels, animals); birth defects, low birth weight, and delayed skeletal development in fetuses (high levels, animals); death</p> <p>Long-term Exposure - damage to sperm and testes (animals); irregular menstrual periods; immune reaction; problems with blood flow in the hands and degredation of bones in the fingers; changes on skin of hand and forearms; changed liver structure; nerve damage; liver cancer, lung cancer, brain cancer, and some cancers of the blood</p> <p>Dermal - numbness, redness, blisters</p>	manufactured or from the breakdown of other manufactured substances (trichloroethylene, trichloroethane, tetrachloroethylene); used in PVC	<p>EPA - 0.002 mg/L (drinking water)</p> <p>NOISH - 1 ppm (air) for 8-hour workday, 40-hour workweek</p> <p>DHHS - known carcinogen</p> <p>EPA - hmn carcinogen</p> <p>IARC - hmn carcinogen</p>	ATSDR's Toxicological Profile
Methylene Chloride	<p>Inhalation - vision and hearing impairment; slowed reaction time, balance problems, and slowed hand-eye coordination similar to drunkenness; dizziness, nausea, and tingling or numbness of fingers and toes; changes in the liver and kidneys (animals); unconsciousness and death (high levels, animals)</p> <p>Long-term Exposure - data is limited regarding humans; cancer (mice)</p> <p>Dermal - intense burning; redness; eye irritant; affects cornea</p>	made from methane gas or wood alcohol; used as an industrial solvent and paint stripper; in certain aerosol and pesticide products; used in manufacturing photographic film; in some spray paints, household products, and automotive cleaners	<p>EPA - 13.3 ppm for 1 day; 1.5 ppm for 10 days (drkng wtr-chldrn)</p> <p>NOISH - 75 ppm in a 10-hour workday in presence of carbon monoxide of 9.9 ppm or less</p> <p>IARC - classified in Group 2B, possible human carcinogen</p> <p>DHHS - anticipated carcinogen</p> <p>EPA - probable carcinogen</p>	ATSDR's Toxicological Profile
Benzene	<p>Inhalation - drowsiness, rapid heart rate, headache, tremors, dizziness, confusion, unconsciousness, and death; low birth weight, delayed bone formation, and bone marrow damage in developing fetus (animals)</p> <p>Ingestion - vomiting, stomach irritation, dizziness, sleepiness, convulsions, rapid heart rate, coma, and death; blood damage, damage</p>	made from petroleum sources; used to make other chemicals (styrene, cumen, and cyclohexane); used in production of some types of rubber, lubricants, dyes, drugs, pesticides, and detergents; naturally produced by volcanoes and forest fires	<p>EPA - 5 ppb (drinking water)</p> <p>OSHA - 1ppm (air) for 8-hour workday, 40-hour workweek)</p> <p>DHHS- known carcinogen</p> <p>EPA - hmn carcinogen</p>	ATSDR's Toxicological Profile

	to immune system, and cancer (animals)		IARC - hmn carcinogen	
Chemical	Health Risk	Source	Standard	Reference
Benzene (cont'd)	Long-term Exposure - disrupts normal blood production; harmful to immune system; cancer of blood-forming organs (leukemia); irregular menstrual periods; decreased size of ovaries; Dermal - redness; sores; eye irritant; cornea damage			
Ethylene Dichloride	Inhalation - nervous system disorders; liver and kidney disease; reduced immune system (animals); cancer (animals); death Ingestion - nervous system disorders; liver and kidney disease; reduced immune system (animals); cancer (animals) Long-term Exposure - kidney disease (animals); cancer (animals) Dermal - lung tumors (animals)	man-made substance; used to make vinyl chloride and substances to dissolve grease and glue; added to gasoline to remove lead; formerly in household products (pesticides, cleaning products, adhesives, and some paint)	EPA - 0.005 mg/L (wtr) OSHA - 1ppm (air) for 8-hour workday, 40-hour workweek DHHS - anticipated human carcinogen EPA - probable human carcinogen IARC- possible human carcinogen	ATSDR's Toxicological Profile (listed as 1,2-Dichloroethane)
Ethylene Dibromide	Inhalation - liver and kidney damage (animals); damage to lining of the nose (rats); birth defects (animals); cancer (rats and mice); death (animals) Ingestion - changes in the liver and kidney; mouth and stomach ulcers; damage to stomach lining (animals); abnormal sperm (animals); cancer (rats and mice); death Long-term Exposure - cancer (rats and mice); bronchitis, headache, and depression; damage to sperm; abnormal sperm (animals) Dermal - blisters; cancer (rats and mice); death	mostly man-made substance(some in ocean); used as pesticide and as gasoline additive	EPA - 0.008 ppm (water); none in food OSHA - avg of 20 ppm (air) for an 8-hour workday; 0.5 ppm (short-term exposure of 15 min) DHHS - anticipated human carcinogen	ATSDR's Toxicological Profile (listed as 1,2-Dibromoethane)
Perchloroethy	Inhalation - dizziness; headache; confusion; sleepiness; nausea; problems speaking and walking; loss of consciousness; liver and kidney cancer (animals); birth defects (animals); death Ingestion - changed brain development in young (animals) Long-term Exposure - menstrual problems; possible spontaneous abortion: cancer (animals) Dermal - irritation	synthetic chemical used for dry cleaning fabrics and metal-degreasing; used for building block to make other chemicals; used as anesthetic agent	EPA - 0.005 ppm (drinking water) OSHA - 100 ppm (air) for 8-hour workday, 40-hour workweek DHHS - anticipated human carcinogen IARC - probable human carcinogen	ATSDR's Toxicological Profile (listed as Tetrachloroethylene)

Chemical	Health Risk	Source	Standard	Reference
Carbon Tetrachloride	<p>Inhalation - headache, dizziness, sleepiness, nausea, vomiting; liver damage; kidney efficiency affected, kidney failure; coma; death</p> <p>Ingestion - birth defects and low birth weight; liver tumors (animals)</p> <p>Long-term Exposure - effects unknown to humans</p>	man-made chemical; used to make refrigerator fluid and propellants for aerosol; used as cleaning fluid in industry for degreasing and in households for spot cleaning; pesticide	<p>EPA - 5 ppb (drk wtr)</p> <p>OSHA - 2 ppm (air) for 8-hour workday, 40-hour workweek</p> <p>DHHS - anticipated human carcinogen</p> <p>EPA - probable human carcinogen</p> <p>IARC - possible human carcinogen</p>	ATSDR's Toxicological Profile
1,1,1-Trichloroethane	<p>Inhalation - dizziness, lightheaded, possible loss of coordination; decreased blood pressure; damage to breathing passages and liver (animals); damaged bone structure in offspring (rabbit); development problems in offspring (rats); unconsciousness; death</p> <p>Ingestion - effects on humans unknown; damage to nervous system and liver (animals); unconsciousness; death</p> <p>Long-term Exposure - effects on humans unknown</p> <p>Dermal - irritation; liver damage and death when evaporation prevented (animals)</p>	synthetic material; used in commercial production, usually to dissolve other chemicals; used in industry to remove oil or grease from metal parts; in households, sometimes an ingredient of a spot cleaner, glue, or aerosol spray	<p>EPA - 0.2 ppm (drk wtr); 18 ppm in lakes and streams</p> <p>OSHA - 350 ppm (air) in 8-hour workday, 40-hour workweek</p> <p>IARC & EPA - not classified as carcinogen</p>	ATSDR's Toxicological Profile
Trichloroethylene	<p>Inhalation - dizziness; sleepiness; headache; damage to facial nerves; liver and kidney damage; change in heart beats; tumors in lungs, liver, and testes (rats and mice); unconsciousness; death</p> <p>Ingestion - birth defects including heart defects; childhood leukemia; developmental problems of the heart (animals); respiratory and eye defects in children; neural tube defects and oral cleft palates in pregnant women; hearing and speech impairments in children</p> <p>Dermal - rashes</p>	used as a solvent to degrease metal parts; used to make other chemicals; in some household products, such as paint removers, typewriter correction fluid, adhesives, and spot removers; formerly used as anesthetic	<p>EPA - 5 ppb (water)</p> <p>OSHA - 100 ppm (air) for 8-hour workday, 40-hour workweek; 300 ppm (15-min avg exposure)</p> <p>IARC - probable human carcinogen</p> <p>Nominated for listing in NTP 9th Report on Carcinogens</p>	ATSDR's Toxicological Profile
Chloroform	<p>Inhalation - fatigue, dizziness, and headache; liver or kidney damage; abnormal sperm (mice); birth defects (rats and mice); miscarriage (rats)</p>	one of the first inhaled anesthetics; used to make other chemicals; forms as a bi-product of adding chlorine to	EPA - 1 ppb (water) for total trihalomethanes, class of chem that incl	ATSDR's Toxicological Profile

Chemical	Health Risks	Source	Standard	Reference
Chloroform (con't)	and mice); Ingestion - liver and kidney damage; miscarriage (rats); colon and urinary bladder cancer; liver and kidney cancer (rats and mice); Long-term Exposure - liver and kidney cancer (rats and mice); link to cancer in humans unknown Dermal - sores	water	chloroform OSHA - 50 ppm for 8-hour workday, 40-hour workweek DHHS - anticipated human carcinogen IARC - anticipated human carcinogen EPA - probable human carcinogen	

APPENDIX A

ABANDONMENT OF KIM-STAN LANDFILL EXPERIENCE

The 24-acre Kim-Stan municipal solid waste/industrial landfill is on a 40.9 acre site located in Alleghany County, a mostly rural locality in west central Virginia. It borders the southern edge of Va. Route 696 and is approximately 1000 feet south of the Jackson River where the base of the Rich Patch Mountains meets the floodplain, a less-than-ideal location for a garbage dump. Spring and surface water, with runoff from the landfill, seep through the waste, causing leachate with waste components to be discharged into surface and groundwater. During heavy rains, runoff from the landfill flowed in sheets northward across the highway and onto a church property and wetlands with ox-bow ponds before entering the Jackson River. DEQ issued a permit for the landfill in 1972 with regulations that required neither a liner nor a leachate collection system.

For 16 years until the fall of 1988, the landfill received an estimated 140,000 tons of waste generated mostly within Alleghany County. In 1988, a Michigan company took control of the landfill, and in 18 months between November 1988 and May 1990, an estimated 725,000 tons of out-of-state waste was dumped at the site. The depth of the waste has been estimated to be up to 80 feet. Waste known to have been disposed at the landfill include 5000 gallons of waste oil contaminated with polychlorinated biphenyl's and unknown amounts of sludges containing mercury, asbestos, and medical waste. Test data indicates wastes derived from hospitals, industrial plants, manufacturing plants, automotive repair facilities, and dry cleaners.

None of the measures to stop runoff from the property worked. Leachate from the landfill caused a fish kill in June 1989, and following court actions, the landfill was ordered closed in May 1990.

When operations ceased, the active part of the landfill was left uncovered, and the soil cover thickness on the rest of the landfill generally was at most 6 inches.

Stopping the landfill's operations did not end its environmental problems. When the landfill operation was stopped, it was already generating an estimated 36,000 gallons of leachate per day. The costs to implement a closure plan was estimated at \$9 million (Initial Closure Action Plan Report for Kim Stan Sanitary Landfill. CH2M Hill. January 1993), which included a clay cover, a layer of topsoil seeded with grass, a methane venting system, and a system for collecting the runoff for treatment at the Clifton Forge sewage treatment plant.

Additional estimated annual post-closure operating and maintenance expenditures required were estimated to be \$135,000.

Closure and cleanup costs were not recovered from Kim-Stan's owners. In September 1990, Kim-Stan, Inc. declared bankruptcy. Virginia was able to recover \$81,000 through the bankruptcy proceeding and \$60,000 from the operator's financial assurance funds. In the meantime, Virginia had already spent over \$450,000 just to stabilize the site and prepare a closure plan.

DEQ reported in Aug 1994 that in spite of efforts by the county and the state, the Kim-Stan site continued to generate leachate containing levels of arsenic, barium and lead exceeding maximum concentration levels established by the U.S. Environmental Protection Agency. Later tests in July 2002 also showed ground and surface water impacts from vinyl chloride, barium, nickel, and thallium. These levels of surface and groundwater contamination pose a danger to human health, especially for area residents who use groundwater as the source of their drinking water.

Alleghany County now bears no responsibility for conditions at the landfill. Cleanup of the Kim-Stan site became the responsibility of both the state and federal government when on July 22, 1999, the site was formally added to the federal National Priorities List, becoming a Superfund site.

On March 20, 2002, according to testimony by DEQ Director Robert Burnley before the Senate Committee on Environment and Public Works on March 20, 2002, Virginia "has already expended millions of its taxpayers dollars to investigate and contain the contamination". (See Appendix D)

Appendix B

Executive Summary of House Document 85

Report of the
Joint Subcommittee Examining

The Appropriate Financial Role and Responsibility, If Any, To Assist Localities in Remediating Abandoned Solid or Hazardous Waste Sites

**REPORT OF THE
JOINT SUBCOMMITTEE EXAMINING**

**THE APPROPRIATE FINANCIAL
ROLE AND RESPONSIBILITY OF
THE COMMONWEALTH, IF ANY,
TO ASSIST LOCALITIES IN
REMEDiating ABANDONED SOLID
OR HAZARDOUS WASTE SITES**

**TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA**



HOUSE DOCUMENT NO. 85

**COMMONWEALTH OF VIRGINIA
RICHMOND
1997**

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EXECUTIVE SUMMARY

The federal Superfund program provides a mechanism for remediating property where improper waste disposal poses a major threat to public health. However, there are many sites throughout the Commonwealth which, while dangerously contaminated, do not qualify for designation for Superfund cleanup. Virginia does not currently have a program for identifying, prioritizing, and remediating such sites where there is no identified and solvent responsible party.

While it may be the largest and most well known example, the Kim-Stan landfill is but one of several hundred sites in Virginia where waste has been improperly managed and poses a substantial risk to health, and where there is no one responsible who can be required to remediate the site. The Department of Environmental Quality (DEQ) has identified 2,015 possible abandoned waste sites in the Commonwealth.

The January 1996 risk assessment prepared by Ogden Environmental and Energy Services Company, Inc., concluded that, based on an analysis of a 250-site sample, Virginia has between 371 and 411 abandoned sites that pose substantial health risks. The cost of their remediation is estimated to fall between \$277 and \$670 million.

A DEQ analysis of the Ogden risk assessment based on business/product sectors indicates that the number of at risk abandoned waste sites may be between 230 and 393. The cost of remediating these sites was estimated at between \$201 million and \$286 million.

A DEQ survey conducted in November of 1993 found that 36 states have an identified funding source for remediating waste disposal sites. The funding source most commonly identified was cost recovery from responsible parties (28 states, including Virginia), followed by landfill tipping fees (15 states), bonds or grants (10 states), general funds (9 states), waste generation fees and transport fees (8 states each), and civil or administrative penalties (7 states).

The joint subcommittee recommends that the Commonwealth establish a comprehensive program to address the problem of abandoned waste sites. Abandoned waste sites should be defined as properties where substances within the jurisdiction of the Waste Management Board have been improperly managed and have not been closed or remediated as required by applicable law, and where (i) title to the site has escheated to the Commonwealth, (ii) the owner has ceased to exist or cannot be determined, or (iii) the owner is known, but the site is not occupied or regularly operated and the owner cannot pay for the site's cleanup. Sites owned by the state (except escheated sites) and local governments, on the National Priority List, or required to be remediated under RCRA, should be excluded from designation as abandoned waste sites. The purpose of the definition is to encompass "orphaned" contaminated sites where no party can be held accountable for the cleanup.

Elements of an abandoned waste site remediation program should include (i) vesting control of both ownership and cleanup of sites in a single agency; (ii) requiring that the designation of property as an abandoned waste site follow a case decision process under the Administrative Process Act; (iii) authorizing the agency to partly or fully close or abate damage caused by abandoned waste sites; (iv) allowing the agency to recoup cleanup costs from responsible parties if they are known and to have a lien on the site for such costs; (v) addressing the appointment of receivers for abandoned waste sites; (vi) preventing the escheat to the Commonwealth of abandoned waste sites; and (vii) immunizing the agency from liability for actions taken with respect to such sites.

To the extent feasible, an abandoned waste site program should rely on incentives to encourage the voluntary remediation of such sites by the private sector. Possible incentives include income tax credits, grants, property tax exemptions, and limits on liability. When necessary, local governments should be provided with incentives to contribute to the cleanup of sites within their jurisdictions.

In order to ensure a rational approach to the problem of abandoned waste sites, a procedure is needed to identify the sites and rank them in order of the threat posed to human health and the environment. Once cleanups of abandoned waste sites are prioritized, plans for their remediation should be prepared that reflect the optimum course of action including voluntary remediation, acquiring title to the site, contracting for remediation, receivership, or seeking injunctive relief. The development of remediation plans should take into consideration funding limitations.

To address these elements of a state program for remediating abandoned waste sites, the joint subcommittee endorses legislation introduced in the 1997 Session as House Bill 2026. The bill vests responsibility for ownership and administration of abandoned waste sites in a new body politic and corporation entitled the Abandoned Waste Site Remediation Foundation. Staffing and administrative support will be provided by DEQ.

Identifying an adequate source of funding for the program has proven difficult. Assuming the minimum estimated cost of remediating abandoned waste sites is \$200 million, a twenty-year cleanup cycle will require \$10 million annually. The joint subcommittee examined funding mechanisms used by other states. Funding options discussed include increases in existing product fees, new pre-disposal fees on certain products, permit fees on waste disposal facilities, and utilizing a portion of the civil penalties and civil charges currently paid into the Environmental Emergency Response Fund. The joint subcommittee recommends that the program be funded in part by voluntary contributions solicited by a non-profit corporation. In addition, initial funding should be provided by diverting a portion of the civil penalties and charges now deposited in the Environmental Emergency Response Fund. Though these identified sources may not be sufficient to allow the program to undertake remedial actions on a large scale, they will permit the agency to begin identifying and prioritizing abandoned waste sites.

Appendix C

East Richmond Landfill (ID 236 and 290) Report

The landfill known as the East Richmond Landfill is listed in the DEQ database as a sanitary landfill with two parts, or cells. The cells were permitted in 1977 and 1980 (or 1979) and the facility is now closed. The closure date is not given for either permit listing. As of August 2000, the landfill was accepting fill material from the construction work at the Convention Center downtown, and also yard waste for mulching.

This landfill is located in a downtown residential area of Richmond, VA and is immediately adjacent to actual or potential homes and apartments. The issue that arises is the health threats from this landfill to the residents in the neighborhood. This letter report addresses the health threats from the contents of the landfill, rather than those health risks from operating the landfill, such as truck traffic, dust and spillage of waste.

Health threats from landfills come from the contents of the landfill and from release of waste and dust during operation of the landfill. Landfills can release materials as gas, liquid, or as particles. Operating landfills can release all three, but closed landfills, as this one is, have a covering that prevents dust from flying about. If this landfill is still receiving construction fill material from downtown, then the operating exposures will still be present. With no activity, the release of particles is not a means of release of the chemicals and other materials from within the landfill. The other two pathways, are, however, applicable to a closed landfill. Air emissions come from the decomposition process generating methane, hydrogen sulfide, carbon dioxide, other organic gases, and from the volatile chemicals. Volatile chemicals are more likely to be released while the waste is still decomposing because of the heat generated by decomposition.

Liquid waste is also released from landfills leaking into the groundwater below, or into the ground below the landfill. Although many landfills are built with some layer to prevent direct and free flow of liquid (leachate), older facilities, such as this one, were not built with highly engineered systems to prevent escape of leachate very effectively; many landfills leak. In fact, in a recent report to the Sierra Club, deFur and Shelley (2002) indicated that approximately 62% of the permitted landfills operating in Virginia in 2002 may be or are known to be contaminating the groundwater at the site. This conclusion was based on DEQ data on groundwater monitoring wells and does include data that show leaking landfills. DEQ makes a distinction between those facilities with chemicals in the groundwater, and those facilities known to be contaminating the groundwater. DEQ, according to state law, requires additional data and analysis before reaching

the conclusion that a facility is contaminating the groundwater on the site. DEQ (and the law) also make an additional distinction when the contamination extends to off-site groundwater.

Thus, individuals living or working at or near a closed landfill are subjected to health risks from consuming or otherwise using contaminated groundwater, and from breathing air contaminated by landfill air emissions.

The greatest public threat for a landfill such as this one is from gases released into the air, assuming that the citizens are using Richmond City water not groundwater and that there is no leaking of leachate onto surface areas or into surface waters. Gases that are routinely monitored are related to combustion; testing measures the ability of gas to explode. Methane is the most common gas that explodes, but landfills often produce sulfurous gases, especially hydrogen sulfide. The other gases are organic chemicals from the waste-solvents, petroleum products, gasoline, etc. These are not measured routinely in landfill gas emissions. Methane (CH₄) is the primary breakdown product from the bacterial degradation of organic material in landfills. In some facilities around the country, this gas production is great enough to use as a fuel for industrial and utility applications.

The routine monitoring of gases in the early 1990's at the landfill showed unacceptable levels (more than 5%) of explosive gases, likely methane. As a result, the City installed gas collecting systems intended to collect, vent and burn the gas. Data were not available on the range of gas and other air emissions from this landfill. Routine permit requirements include air monitoring of methane, oxygen and carbon dioxide levels in landfill gas. Since installation of the gas collection system at the East Richmond Landfill, methane levels have dropped to acceptable levels and recent analyses show no methane in the landfill gas monitoring wells.

As described in laws and regulations, landfills also are supposed to monitor groundwater in the area. The permit for this landfill does not have a requirement for groundwater monitoring, but closure plans should have addressed this issue. The only data in the DEQ Piedmont Office files concerning groundwater indicate that in 1990 there were some groundwater chemicals elevated in the landfill wells compared to background wells. This trend is one of the first indications that a landfill is leaking. Apparently, this evidence or other was sufficiently compelling that DEQ staff recommended testing the groundwater for contamination (DEQ Memo from James Scott Bullock to Rob Timmons, Sept. 18, 1995; re Potential open Dumps). The DEQ files gave no evidence of follow-up on the recommendation to test groundwater for contamination.

Research into reports and investigations of landfill gases gave little information on the chemical composition of routine gas emissions from municipal landfills. The one report that gave real information on the subject was from California. The state of California completed a survey in 1990 of some chemical

constituents of landfill gas emissions (CARB, 1990). The CARB did not undertake a comprehensive evaluation of landfill gases, rather the sampling and testing included ten volatile organic compounds plus methane, oxygen, carbon dioxide and nitrogen. The ten chemicals were pre-selected based on the information on landfill contents. All ten are volatile organics, such as the solvents benzene and methylene chloride. All were found in the landfill emissions, although these were municipal solid waste landfills, not industrial landfills with high levels of such waste. CARB also measured levels of these chemicals in the ambient air and found that all did occur outside the boundaries of the facility, albeit at lower levels.

Conclusions and Recommendations:

The East Richmond Landfill has presented several problems that threaten human health, especially the residents in the neighborhood. These include the noise and dust from operations, the presence of elevated methane in the gas emissions and groundwater that may be contaminated by the landfill. This facility warrants a greater level of scrutiny and investigation.

The City has been slow to comply with the requirement for submitting a final closure plan to DEQ for approval.

Only the problem of methane emissions has been investigated and mitigated.

Neither DEQ nor the City of Richmond know if other gaseous emissions are coming from the landfill, in large part because no measurements are being made. The gas emissions should be monitored for volatile and semi-volatile organic chemicals.

There is preliminary evidence that the landfill is leaking into the groundwater. As concluded by DEQ, the groundwater should be monitored for the full range of chemicals that might be present and originating from the landfill.

Considering the age and location of this landfill, DEQ and the City should not assume that this landfill poses no health risks, rather, the opposite is true. As a matter of public health protection, this facility should be subjected to a complete investigation to determine the extent and nature of releases of any and all types of chemicals, biological agents and other materials from this facility.

Prepared by:
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December 23, 2002

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California Air Resources Board. (CARB) 1990. The Landfill Testing Program: Data Analysis and Evaluation Guidelines. California Air Resources Board, Sacramento, CA. 29 pp, plus appendices and attachments.

deFur, P.L and S. Shelley. 2002. Landfills in Virginia: Sources of Contaminants. Report to the Sierra Club-Virginia Chapter, Richmond VA. 14 pp.

Ogden Environmental and Energy Services, Inc. (Ogden) 1996. Environmental Risk Assessment Final Report. Submitted to Virginia DEQ, Superfund Section. January 8, 1996. Ogden Services, Westford, MA 01886.

Database listings for the two East Richmond Rd landfills:

Name: East Richmond Rd Alias:
ID: 236 Permit Date: 28-Nov-77
Type: Sanitary Landfill Status: Closed
Contact: BUREAU ENV MGT Phone: (804) 780-6410
Address: 900 E Broad St. Richmond, VA 23219
Owner: RICHMOND CITY
Operator: RICHMOND CITY

Name: East Richmond Rd SLF Alias:
ID: 290 Permit Date: 08-Feb-80
Type: Sanitary Landfill Status: Closed
Contact: BUREAU ENV MGT Phone: (804) 780-6410
Address: 900 E Broad St. Richmond, VA 23219
Owner: RICHMOND CITY
Operator: RICHMOND CITY

Appendix D

STATEMENT OF ROBERT G. BURNLEY, DIRECTOR VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

March 20, 2002

Introduction

Good morning Mr. Chairman and members of the Committee. I am Bob Burnley, Director of Virginia's Department of Environmental Quality. I appreciate the opportunity to speak to you about Virginia's concerns about interstate waste.

Solid Waste Management and Interstate Waste Disposal in Virginia:

Governor Warner and I are concerned about interstate waste because landfills consume open space and threaten the quality of our environment. While every state has a responsibility to ensure adequate and safe waste disposal capacity for its citizens. Virginia should not be forced to assume these long-term costs and increased risks for other states. We should not have our hands tied as we attempt to protect ourselves from the onslaught of garbage from other states.

Virginia is second in the nation in the amount of out-of-state waste received. Over the last decade, the amount of out-of-state waste imported to Virginia has more than doubled. In 2000, Virginia imported 4.5 million tons of solid waste. This represents more than twenty percent of Virginia's total waste stream.

Landfill permits consume approximately 10,000 acres in Virginia. This capacity will last until 2014 if disposal volumes remain constant. If, however, Virginia is not able to cap the flow of waste from other states, we may be forced to provide additional landfill space at a much earlier date.

The U.S. EPA acknowledges that, despite our best technology, all landfills will leak eventually. Virginia has enacted very stringent requirements for the siting, monitoring, and operation of its landfills, more stringent than those established by EPA. Despite our best efforts to protect Virginia's environment, however, we do not know what will happen twenty or thirty years from now. Common sense tells us that the larger the landfill and the more waste we are forced to accept, the greater the risks of ground water contamination and other pollution.

Unfortunately, Virginia has already suffered the consequences of uncontrolled shipment of outof-state waste. The Kim-Stan Landfill in western Virginia was originally operated as a local landfill but was later purchased by private interests. In the subsequent months they began importing waste from other states, increasing the volume significantly. Hundreds of tractor-trailers filled with trash traveled the back roads of rural Allegheny County each day. The owners soon filed bankruptcy and the landfill is now a Superfund site. The Commonwealth has already expended millions of its taxpayer dollars to investigate and contain the contamination; neither the generators nor the generating state have borne any of these costs. We hope our enhanced landfill regulations will prevent this type of environmental catastrophe from happening in the future, but the fact remains that no one is certain that current landfill designs are adequate to provide long-term environmental protection.

Another concern is our inability to enforce against generators who send their waste to Virginia facilities. Virginia prohibits certain types of waste from its landfills that are allowed in the municipal

solid waste streams of other states. Without the ability to limit imports from these states, Virginia is forced to expend more of its state-funded compliance resources at landfills accepting wastes from other states. When violations are found, however, we have no authority to pursue enforcement against the source of the waste if they are outside Virginia.

In 1998 and 1999, DEQ found illegal wastes in loads of trash coming from New York City. In the resulting litigation, the Virginia State Courts found that it would be impossible for a New York City transfer station to adequately screen the trash to prevent these banned wastes from making their way to Virginia's landfills unless the volumes were significantly curtailed. The federal courts, however, have prevented us from imposing any limits or caps on the disposal of these wastes because it would violate the Commerce Clause of the Constitution.

Every day, trains filled with garbage travel Virginia's railways, many parking along the way while they wait their turn at the landfill. Tractor trailers filled with garbage work their way through the crowded interstate system and across rural Virginia. At least one of Virginia's landfill operators plans to use barges to import garbage. Each barge will bring approximately 250 tractor-trailer loads of trash across the Chesapeake Bay and up the James River. Virginia has tried to protect itself by imposing disposal caps, regulating large trash trucks, and imposing restrictions on trash barges; but the federal courts have blocked these efforts.

Virginia's Goals:

The Commonwealth seeks the authority to control how our natural resources are consumed and protect the long-term welfare of our citizens. In order to do this, we are asking Congress to grant states the ability to control the importation of garbage. This authority should be simple and flexible enough to meet the needs of all states, without basing it upon the solid waste management system of one particular state.

For example, some of the legislation being considered would authorize states to cap-waste imports at 1993 levels. Virginia first collected verifiable information on waste imports in 1998. The Department of Environmental Quality has been working with Senator Warner and other members to identify these concerns and I hope that we will be able to address them before any action is taken.

I applaud the Committee for continuing its efforts to address this issue. Thank you for the opportunity to present Virginia's concerns about interstate waste disposal. I would be happy to work with you and your staff to move such legislation forward. This concludes my prepared remarks, and I will be happy to answer any questions.

Appendix E

Results of 1996 Ogden Risk Assessment of 250 Sites (listed as Abandoned)

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Environmental Risk Assessment Final Report

Key to 250 Site Sample

Non-Abandoned Sites, Stricken (117 sites)

- 15 QUARRY SPOIL DEBRIS DUMP, WARREN
- 18 WISE MT. LANDFILL, WISE
- 19 MONTCLAIR COUNTRY CLUB DRUMS, PRINCE WILLIAM
- 21 TRANS CIRCUITS INC., FALLS CHURCH
- 28 DAVIS INDUSTRIES, FAIRFAX
- 29 I-95 LANDFILL (LORTON), FAIRFAX
- 31 INDEPENDENCE HILL, PRINCE WILLIAM
- 37 CHERRY HILL LANDFILL, PRINCE WILLIAM
- 41 THE PLACE WHERE LOUIE DWELLS, ALEXANDRIA
- 44 GMC DELCO DRUM/SLOUGE SITE, SPOTSYLVANIA
- 46 FREDERICKSBURG ROD & GUN CLUB, FREDERICKSBURG
- 48 HOOVER UNIVERSAL INCORPORATED, CAROLINE
- 50 FMC CORP., SPOTSYLVANIA
- 52 NORTHERN NECK COMBUSTION, RICHMOND
- 53 WOOD PRESERVES-LAGOON, RICHMOND
- 54 MOORES BUILDING SUPPLY, WINCHESTER
- 57 BROWNING FERRIS LANDFILL, CLARKE
- 59 WARREN COUNTY MIDDLE SCHOOL, WARREN
- 62 BINGHAM & TAYLOR LANDFILL, CULPEPER
- 69 VIRGINIA OAK TANNERY LANDFILL, PAGE
- 71 BRYANT WASTE MANAGEMENT, RT 610 & RT 670, BUCKINGHAM
- 72 GENERAL ELECTRIC, CHARLOTTESVILLE
- 73 CROUSE-HINDS COMPANY WASTE (Cooper Ind), ALBEMARLE
- 76 GARDNER JUNKYARD, ORANGE
- 79 VIRGINIA PLATING AND POLISHING, HANOVER
- 80 BRAVER DAM LANDFILL, HANOVER
- 81 RICHMOND LUMBER COMPANY, CHARLES CITY
- 85 GOOCHLAND COUNTY STATE FARM, GOOCHLAND
- 87 PHILBATES JUNKYARD, NEW KENT
- 88 RT 609 TALLEYSVILLE SITE, NEW KENT
- 90 VA AIR NATIONAL GUARD, HENRICO
- 94 WALTRIP LANDFILL, WILLIAMSBURG
- 96 SCHNEIDER LANDFILL, RICHMOND
- 97 REYNOLDS METAL DRUM (Lewis) Site, RICHMOND [Chesterfield]
- 98 RUTHERFORD JANITORIAL SUPPLY, RICHMOND
- 100 DOUGLAS CHEMICAL, RICHMOND [Henrico]
- 103 RICHMOND METRO AUTHORITY QUARRY, RICHMOND
- 104 BATTERY COMPANY DUMPING, HENRICO
- 105 HASKELL CHEMICAL PLANT, RICHMOND
- 109 REYNOLDS-SOUTHERN GRAVURE, RICHMOND
- 111 FT. DARLING LANDFILL, CHESTERFIELD
- 112 DSI TRANSPORTATION, RICHMOND
- 113 PHILLIP MORRIS, 4200 DEEPWATER TERN RD, RICHMOND
- 114 VEPCO- CASTLEWOOD RD, RICHMOND
- 116 EI DUPONT PLANT LANDFILL-RICHMOND, RICHMOND
- 119 BACK BAY DUMP, CHESAPEAKE
- 121 CITY OF CHESAPEAKE DRUM SITE, CHESAPEAKE
- 122 ELIZABETH RIVER TERMINAL SITE, CHESAPEAKE
- 127 FIELOS ESTATE PROPERTY, CHESAPEAKE
- 128 JACOBSON METAL COMPANY, CHESAPEAKE
- 129 N & W RAIL SITE -PORTLOCK YARD, CHESAPEAKE
- 136 VA BEACH GARDEN PARK SITE, VIRGINIA BEACH
- 137 E CALLIGORY, 133 INGLESIDE RD., NORFOLK
- 138 COMPESTELLA LANDFILL, NORFOLK
- 143 RIDGE ROAD DUMP, YORK
- 144 ANDREWS ST, HAMPTON
- 145 VA EMERGENCY FUEL STORAGE, YORK
- 148 WYKOFF PIPE & CREOSOTING, PORTSMOUTH
- 149 PORTSMOUTH MARINE TERMINAL, PORTSMOUTH
- 150 RANDOLPH FARM DRUM SITE, CHESTERFIELD
- 152 TAYLOR-RAMSEY CORP, NOTTOWAY
- 153 F & S GENERATOR-WALTHALL, CHESTERFIELD
- 155 BOW AIR LANDFILL, CHESTERFIELD
- 156 CHESTERFIELD FIRE DRUMS, CHESTERFIELD
- 157 JAMES RIVER SITE, CHESTERFIELD
- 158 BENJAMIN MOORE'S SOLVENTS, COLONIAL HEIGHTS
- 159 COMBURN OPTICAL, COLONIAL HEIGHTS
- 160 COLONIAL HEIGHTS DUMPSITE, COLONIAL HEIGHTS
- 162 LEE'S MILL ROAD LANDFILL, FRANKLIN
- 163 COGNETRICS (JTM Industries), SOUTHAMPTON
- 164 CONTINENTAL FOREST DUMP, HOPEWELL
- 165 HOPEWELL CHEMICAL PLANT, HOPEWELL
- 168 STONE CONTAINER-LAGOON, HOPEWELL
- 174 J H WILLIAMS JUNKYARD, PRINCE GEORGE
- 177 FALWELL AVIATION, LYNCHBURG
- 178 ANDERSON TIRE COMPANY, BUCKINGHAM
- 179 LUNENBURG FARM, LUNENBURG
- 182 VA-EASTERN DEVELOPERS, ROANOKE
- 183 6405 COMMONWEALTH DR, SW, ROANOKE
- 185 ARCADIA DUMP, BOTETOURT
- 186 THOMPSON DRUM LANDFILL, MONTGOMERY
- 187 ELECTROPLATE-RITE CORP, PULASKI
- 191 CELCO DUMP, GILES
- 192 LYNCHBURG FOUNDRY PLANT, RADFORD
- 193 SOUTHERN ADHESIVE COMPANY (SEACO), HENRY
- 194 KOPPERS ROANOKE VALLEY PLANT, SALEM
- 196 HOWLES SPRING PARK LANDFILL, SALEM
- 197 SALEM ELECTRIC DEPARTMENT, SALEM
- 198 HOLDEN BATTERY SERVICE, BRISTOL
- 199 M. W. MARKET, BRISTOL
- 201 TWIN CITY IRON & METAL, BRISTOL
- 205 COPPER RIDGE ROAD SITE, RUSSELL
- 209 HERCULES PLANT- PULASKI, PULASKI
- 210 HERCULES-HIWAHEE LANDFILL, PULASKI
- 211 AUSTINVILLE MINES, WYTHE
- 213 APPALACHIAN POWER COMPANY, GRAYSON
- 214 IVANHOE CARBIDE QUARRY, WYTHE
- 219 ALLIED CHEM-COVINGTON WORKS, COVINGTON
- 220 COVINGTON PLANT-EDGEMONT DRIVE, COVINGTON
- 222 AUGUSTA CORRECTIONAL INSTITUTE, AUGUSTA
- 223 STUMP'S SCRAP YARD, AUGUSTA
- 224 ARCHER CREEK LANDFILL, LYNCHBURG
- 225 LYNCHBURG TOWN GAS, LYNCHBURG
- 227 BUNCHER RAILCAR SERVICE COMPANY #2, LYNCHBURG
- 230 LYNCHBURG FOUNDRY-DISPOSAL, LYNCHBURG
- 231 AMHERST DRUM DISPOSAL AREA, AMHERST
- 232 BEDFORD PCB SPILL, BEDFORD
- 233 RUBATEX CORP HOLLAND FARM, BEDFORD
- 234 TRANSCONTINENTAL GAS PIPE LINE, PITTSYLVANIA
- 237 DISSTON LAGOON, DANVILLE
- 238 DIXIE AUTO-SUPPLY CENTER, DANVILLE
- 239 GOODYEAR TIRE AND RUBBER, DANVILLE
- 243 BEASLEY FARM #1, CAMPBELL
- 245 GUTHERIE SCRAP METAL DUMP, HALIFAX
- 246 1ST PIEDMONT LANDFILL, PITTSYLVANIA
- 247 C-K COMPANY METALS, SOUTH BOSTON
- 248 SOUTH BOSTON SLOUGE DISPOSAL, SOUTH BOSTON

Sites Found "At Risk" (38 sites)

- 25 HERNDON LUMBER & MILLS WORKS, PRINCE WILLIAM ✓
- 26 OFF RT 7, E. RT 28, LOUDOUN
- 30 ROY'S AUTO MACHINE, MANASSAS ✓
- 38 OLD ROBINSON TERMINAL #1, ALEXANDRIA ✓
- 39 ORONO & PENDLETON STS, BOGLE, ALEXANDRIA ✓
- 40 RL RAND AND COMPANY, ALEXANDRIA ✓
- 51 KING LAND LANDFILL, KING LAND CORP., ESSEX ✓
- 63 JIM'S LIQUID WASTE, CULPEPER ✓

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Key to 250 Site Sample

66 LIPICH FARM, FAUQUIER
67 BURDA PROPERTY, FAUQUIER
70 GANG-NAIL SYSTEMS INC, ALBEMARLE
75 EVERDURE INC, ORANGE
77 ELMONT DUMP, HANOVER
78 VA GALVANIZING CORP, HANOVER
83 WEYERHAUSER DUMP, HANOVER
93 WILLIAMSBURG PLANT LANDFILL, RT 60, WILLIAMSBURG
106 AT & T TECH SYSTEMS, RICHMOND
108 HYMAN VIENER & SONS, RICHMOND
117 1316 SMITH DOUGLAS RD, CHESAPEAKE
125 BERNUTH LEMBECKE TANKS, CHESAPEAKE
126 EPPINGER & RUSSEL, CHESAPEAKE
130 REPUBLIC CREOSOTING COMPANY, NORFOLK
134 MEARS PROPERTY, ACCOMACK
141 COMMONWEALTH WOOD PRESERVERS, HAMPTON
147 RL BRANDT & SONS, YORK
151 PETERSBURG TOWN GAS, PETERSBURG
167 NORWOOD WILSON SR FARM DUMP, HOPEWELL
169 DUPLAN CORP MCKENNY, DINWIDDIE
170 DUPLAN CORPORATION LANDFILL, DINWIDDIE
171 OLD MCKENNEY LANDFILL, DINWIDDIE
175 SUSSEX COMPANY TIRE FIRE, SUSSEX
184 AMERICAN VISCOSSE COMPANY, ROANOKE
195 LEAS-MCVITT TANNERY, SALEM
208 ALLIED CHEM CORP PULASKI WORKS, PULASKI
215 POWERBOSS INDUSTRIAL BATTERIES, SMYTH
216 BEVERLY EXXON, STAUNTON
228 LYNCHBURG FOUNDRY-DUMP, LYNCHBURG
229 LYNCHBURG FOUNDRY-TANKS, LYNCHBURG

Data Limited or Restricted (31 sites)

2 GLENLAND, GILES
3 MT. VALLEY DUMP, HENRY
4 WOOD PROPERTY, LOUISA
9 CRIDERS AREA DUMP, ROCKINGHAM
10 RED OAK RIDGE DUMP, RUSSELL
11 RTE 643 DUMP, SCOTT
12 RTE 718 DUMP, SCOTT
13 1 MI S. OF I-522 & 55, WARREN
14 1 MI W. OF U.S. 522, OFF DUCK STREET, WARREN
16 DAMASCUS OLD SITE, WASHINGTON
24 BEST REFUSE COMPANY OIL DUMPING, FAIRFAX
25 J & J ACRES LANDFILL, LOUDOUN
42 RT 725, DOSWELL, HANOVER (Caroline)
47 E. OF RT. 601 & N. OF RT. 3, KING GEORGE
59 PAPERMILL RD. LANDFILL, WINCHESTER
74 WRIGHT DUMP, NELSON
84 DONALD SIGMAN'S BACKYARD, HANOVER
107 CHARLES CITY LANDFILL, RICHMOND
115 C & R BATTERY LANDFILL, RICHMOND
123 1928 ORANGEWOOD ROAD, CHESAPEAKE
146 FOREST PIT DUMP, YORK
166 NORWOOD WILSON DUMP, HOPEWELL
172 A. FORBES & N. WILSON PROPERTY, PRINCE GEORGE
181 ROANOKE TOWN GAS SITE, ROANOKE
200 OLD SOUTHERN RAILROAD, BRISTOL
203 GOLDEN CHIP COAL, DICKENSON
212 I-81-DRAPER, PULASKI
217 HEINRICH FARM, STAUNTON
218 FRIDLEY SITE, RT 220 NORTH OF COVINGTON, ALLEGHANY
236 DANVILLE BRANCH PLANT, DANVILLE
240 MARSHALL CONSTRUCTION DUMP, DANVILLE

"Low Risk" Sites, No Remedial Costs (64 sites)

1 BRINKERS NECK DUMP, CAROLINA
5 CRAIG CREEK LANDFILL, MONTGOMERY
6 MULLER SITE, NEWPORT NEWS
7 JAMES BOLDEN SITE, RT 116 & PEPPER FAIRY RD, PULASKI
8 CAT POINT CREEK DUMP, RICHMOND
17 MUDHOLE DUMP, WISE
20 JEFFERSON STREET DUMP, FALLS CHURCH
22 DRUMS AND FISHKILL, FAIRFAX
27 SYCOLIN RD. & COCHRANMILL RD., LOUDOUN
32 MOUNT VERNON WASTE DUMP, FAIRFAX
33 NORTHERN VIRGINIA STEEL CORP, FAIRFAX
34 MELOY LABORATORIES INC LANDFILL, FAIRFAX
35 US PRINTING INC CORPORATION, FAIRFAX
36 UNITED FIBER GLASS CORPORATION, PRINCE WILLIAM
43 CHUCKS AUTO BODY SHOP, FREDERICKSBURG
45 YOUNG DRUM SITE, RT 608, STAFFORD
49 SALT MARSH DRUMS, WESTMORELAND
56 BERRYVILLE SITE, CLARKE
58 RUTHERFORD SALVAGE YARD, WARREN
60 RT 2 BOX 4, EYTON, FREDERICK
61 CHEMSTONE DRUMS, SHENANDOAH
64 RT 762, CULPEPER
65 COLLIER KINGSBURY ASBESTOS DUMP, MADISON
68 HAWKINS BODY SHOP, MADISON
82 SHIRLEY PLANTATION LANDFILL, CHARLES CITY
86 MOB JACK BAY DRUM SITE, MATHEWS
89 MORRIS SITE, NEW KENT
91 TALTON PROPERTY-TOANO, JAMES CITY
92 CAPITOL SITE, LOUISA
93 WALKER SITE, RT 262, MIDDLESEX
99 3334 STUART AVENUE APT. A, RICHMOND
101 430 CEDAR FORK RD, HENRICO
102 317 N. 28TH ST., RICHMOND, RICHMOND
110 BOWHOLLOW DRIVE DRUMS, HENRICO
118 645 GREAT BRIDGE BLVD, CHESAPEAKE
120 BP LUMBER SITE, CHESAPEAKE
124 GIMMERTON CUT- DEEP CREEK, CHESAPEAKE
131 209 N. MAIN ST, ACCOMACK
132 CHESAPEAKE WILDLIFE FOUNDRY, ACCOMACK
133 MELFA WELL, ACCOMACK
135 MURRAY DEBRIS LANDFILL, VIRGINIA BEACH
139 NORFOLK ASPHALT TANK FARM, NORFOLK
140 K-MART CORPORATION-NN SITE, NEWPORT NEWS
142 CARYS CHAPEL DUMP, YORK
154 WOOD DALE RD. BARREL SITE, CHESTERFIELD
161 FRANKLIN DUMP, FRANKLIN
173 EDWARD COLLIER PROPERTY, PRINCE GEORGE
176 DEWEY RATES SITE, RT 767 & RT 695, PRINCE EDWARD
180 ROANOKE RIVER DRUM SITE, ROANOKE
188 MEADE CORP LANDFILL 2, FRANKLIN
189 LEWIS WAGNER PROPERTY, MARTINSVILLE
190 TEXACO TERMINAL TANK, BEDFORD
202 AMERICAN DYNAMIDE DUMP, WASHINGTON
204 HAYS ABANDONED TRANSFORMERS, DICKENSON
206 GLENN ROBERTS TIRES, WISE
207 STRAIGHT CREEK AT RT. 352, LEE
221 WESTVACO, NE GRAD OF PROPERTY, COVINGTON
226 A STORAGE INM, LYNCHBURG
235 PAULS AUTO PARTS WASTE SITE, DANVILLE
241 MOUNTAIN HILL RD., DANVILLE
242 WRENN DRIVE DUMP, DANVILLE
244 FRED BLAIR SITE, RT 29, PITTSYLVANIA
249 CLIFFIELD DRUM, TAZEWELL
250 RT 91, TAZEWELL